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TABLE OF CONTENTS

Page

Editorials:

One of the Peaks 2
Work for the New Government 2
New Uses for Rubber 3
An appreciation of a Canadian Chemical Engineer.. 3
Co-operation Among Scientists 3
The Phospho-Potash Process 4
Ontario's Mineral Production—Large Increase in Gold Produced 4
Industrial Minerals in Northern Saskatchewan 4
A Review of the Work of Ernest A. Le Sueur. By L. E. Westman 5
Modern Developments in the British Brass Industry (concluded) By Ernest A. Smith 8
Handling Sulphuric Acid in Tank Car Shipments. By Gerald A. Foot 13
The Prevention of Rust on Iron and Steel 13
Blast Furnace Gases as Plant Fertilizers 14
Estimating World's Rubber Surplus 14
Report of Toronto Meeting of American Association for the Advancement of Science 15

Chemical Society News:

Meeting of Toronto Section, Society of Chemical Industry, December, 1921 16
Book Reviews 16
Two Rising Chemists: William H. Thom and Joseph Harris, M.P. 17
Overseas and Foreign Industrial News—Special Review of Overseas Chemical Markets During 1921.. 18
Mining and Metallurgy in British Columbia 21
Northern Ontario Mining Developments 22
Chemical and Metallurgical Patents. By A. E. MacRae 23
Western Oil Developments 23
Report on Canadian Manufacturers, 1919 24
Reports and Catalogues Received 24
Market Review and Prices 25
Buyers Guide.... 43. Classified Advertisements.... 50
Index to Advertisers 52

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EDITORIALS.

ONE OF THE PEAKS.

AN element in successful scouting is that the backward track be studied frequently, because things differ when observed in prospect and retrospect. For one thing, we see the chains which bound those lions we passed with such faint hearts.

December, 1921, is to be one of the peaks in the range of time.

On December the seventh the Canadian strap-hanger spread his feet apart, tucked his wife's letters where he'd be sure to forget them, opened up his paper, confirmed his overnight information on the elections; then saw that an agreement had been reached between the British and Irish conferees in Downing Street, and that Japan had consented to the Hughes naval ratio plan, making possible the four-power agreement in the Pacific. The pendulum is swinging to peaceful adjustments.

The irresistible power of good-will is gaining impetus. Force as a referee has lost the support of the plain people, and the statesmen of the world are coming more and more from the plain people.

The social joys and mental exhilarations of those meetings of British and American chemists in Canada and the States were musical, too, with an overtone of spiritual insistence that life is more than meat and raiment—that matter must be the servant of soul.

Even paganism is coming to see the logical force of the law of love and the gospel of peace.

With good will and good work, we should be able to look into 1922 with high hearts.

THE OUTLOOK BACKWARD.

WHILE the world's 1921 production of pig iron is less than 50 per cent. of the 1913 output, it is interesting to note that, in the latter part of this year, our Canadian furnaces are slowly increasing their product.

The Canadian farmer has to face a loss of over $430,000,000 in crops, as compared with last year's values. The actual crop was good—the shrinkage being in prices.

One market states that more five-cent cigars and pipe tobacco were being smoked, and that there was a falling off in high-priced cigars. As well as any other item, we believe this might be taken to indicate a sense of restraint which should be wholesome.

There are signs that industries are coming to use the services of chemists and chemical engineers to a greater extent.

Canadian Victory Bonds and the Canadian dollar enter the New Year under greatly improved conditions. The seven bond issues averaged $96.78 in November, 1920, and $99.71 on December 14, 1921. The pound is creeping up steadily.

Canadian trade in the twelve months ending October, 1921, showed a favorable balance of $67,000,000.

WORK FOR THE NEW GOVERNMENT.

ASIDE from any party issue, we believe the country breathes more freely as a result of feeling that a strong element has been placed in power by the process of election.

Two things which have been shelved or become inoperative for various reasons may now be carried through. Industrial Training and Technical Education were made the subject of investigation by a Royal Commission under the former Liberal Government. This Commission reported, however, under a Conservative regime, and was promptly tabled or shelved until a year or two ago, when effect was given in part to some of its recommendations.

The incoming Premier, Mr. King, who is the first trained political economist to reach that office, is known to be interested in matters of industrial education, so we shall look for positive action here.

Perhaps it is not too much to hope that the incoming administration will be able to secure action in the research matter, also. In this case the issue was not of party, but between the two Houses. There are several new senators, and if the bill comes before Parliament again, it should stand a fair chance of passing.

There will naturally be some tariff action. Nobody expects that extremists at either end will have their way. We know Canadian industries need protection, but we think of protection as a shield rather than a battle-axe. If it were quite effective in protection, it would fail as a revenue producer. The idea that any country can make its industrial competitors an important source of revenue is illusory. The people of a nation pay their own bills—either directly or indirectly— the latter at increased cost for collection. There may be some revenue incidental to protective measures, but it's an expensive way to pay our maintenance charges.

There are evidences that the action of the new Government will be along the lines of safeguarding our strong natural industries, and those others upon which they depend.

Is it too much to hope that some step can be taken which will place tariff maters in the hands of a commission that can function on details without party involvement?

NEW USES FOR RUBBER.

IN June, 1920, the Rubber Growers' Association initiated a competition for ideas and suggestions regarding new uses for rubber. The prize money amounted to £4,000, of which £1,000 was for the first prize. Some ten thousand suggestions were received, and so great was the task of sifting out the good, fair and poor suggestions, that it was eight months before any results could be announced.

The first prize was awarded to a suggestion for the use of sponge rubber for upholstering purposes, although the idea was not absolutely novel. But the sad part of it is that, as no fewer than 114 competitors submitted this particular suggestion, they will each have to be contented with something under £9. Those who came second in the contest are really better off than the "firsters," for the second prize (a device for incorporating rubber with paint as a preservative), valued at £500, is divided among five competitors only.

The results of the contest have proved disappointing to the judges, for no new fundamental idea was submitted. Apart from those that were the direct result of modern developments, scarcely one proposal was put forward that was not mentioned by Goodyear, in his book, "Goodyear on Gum Elastic," published nearly seventy years ago. "The Chemical Trade Journal and Chemical Engineer" (London), in commenting on the judges' awards, sums up the situation very well indeed, when it says:

> "We hardly know what the Rubber Growers' Association did expect as a result of the competition, but apart from the improbability in itself of the discovery of a brand new use for rubber, capable of absorbing the material in thousands of tons, did they imagine that in the event of such a contingency really maturing, the inventor would abstain from obtaining patent protection and submit his idea to them with the maximum reward he could hope for the thousand pounds first prize, and with the knowledge that whether his invention received a prize or not, he had relinquished all his rights to it? After all, the majority of inventions of proved value which are being exploited to-day, have brought in an enormously greater reward to industry as a whole than they have to the inventors themselves. The rubber industry is no exception, as the recent death of the inventor of the pneumatic tire recalls and emphasizes."

Competitions such as the above may well prove a good incentive to the inventor, but either patent protection should be allowed the competitor, or the rewards should be so liberal that the inventor of a really worth-while process or use will be much better reimbursed than has frequently been the case in the past.

AN APPRECIATION OF A CANADIAN CHEMICAL ENGINEER.

WE are publishing an account of the work of Ernest A. LeSueur of Ottawa. It has seemed to us for some time that Canadian chemists, generally speaking, were not sufficiently familiar with the work of a man who ranks among the foremost chemical engineers residing in the Dominion or elsewhere. Mr. LeSueur is not the type of man who pushes himself forward on the platform of scientific celebrities. His genius has not met with a vast financial reward, but he has the personal satisfaction of research work well accomplished, and we propose to place on record a chapter or two of chemical history which has not been previously written. We are doing this not alone because it relates to the work of a Canadian, but rather for the reason that it is fundamental to some gigantic electrochemical industries which received their start in America as a whole from the work of this man. We believe that this sketch of the work of LeSueur will be read with the greatest interest by chemists everywhere, but particularly those concerned with electrochemistry, and those younger members of the profession who may be stimulated and guided by such a career.

CO-OPERATION AMONG SCIENTISTS.

IF any one section of the American Association for the Advancement of Science had come to Canada for a meeting, it would have caused a faint stir in the daily press and would have been but a passing item of interest to a few individuals.

But when sections representing the sciences in the very broadest way and in sufficient numbers to take up nearly the whole alphabet in their designation meet for one week, the result is a net gain for all in the publicity scientific work receives. Canada welcomes scientific gatherings within her borders because she realizes that through the work of scientists her resources must be developed and business created and carried forward.

The Toronto meeting was a real success. The facilities of the University were ample, and many and splendid were the papers given. Relating the work of specialists is in its infancy, but if super results are to be obtained in reasonable time, we cannot have too much of it.

This organization has good work to do, and we believe is doing it better year by year. Those Canadians who were privileged to attend the meetings will look forward with a new interest to further visits.

THE POETRY OF THE SCIENCES.

To the Editor of Canadian Chemistry and Metallurgy.

Dear Sir: I am making a collection of verses, whose subject-matter relates to some one of the sciences, with the intention of publishing an anthology of such verse, under the title, "Jingles of Science." It has occurred to me that there are probably many verses of this character in the possession of the engineers, chemists, and other scientific men of Canada. Will you kindly grant me space for this appeal to your readers to send to me copies of such verses, together with the names of their authors, and other essential details, at my address, No. 7 St. Paul, Cambridge, Mass., U.S.A.? Such verses, sent to this address, will be greatly appreciated, and duly acknowledged.

CHARLES E. RUBY.

We trust that Canadian chemists will co-operate with Dr. Ruby in this matter. Some of them may have "efforts" stored away which they have never made public or which still remain in an unfinished state. Perhaps others may be stimulated to make their first attempt in verse at this suggestion.

THE PHOSPHO-POTASH PROCESS.

This process for the extraction of potash from silicates, such as feldspar, greensands, mine tailings and the like, is described by F. D. S. Robertson, a Toronto metallurgist, in Canadian Patent 191260 and United States Patent 1317524.

The special feature of this novel process is that all the materials are locally procurable, in their raw state, in such districts where potash silicates are generally obtained, together with the fact that all products and by-products are utilized and commercialized. The principal points essential to the success of any potash process are (1) The supply of raw material must be ample and readily accessable for transportation, as the tonnage used is large, and (2) Every pound of material must be converted into a market commodity that can be readily sold at a price sufficient to cover cost and at a profit either by way of added weight to an article produced or as a specific by-product.

The process consists in grinding the feldspar, or other potash containing material, to about 80 mesh, or finer, and subjecting it for a short time to the action of phosphoric acid, obtained from rock phosphate electrically, under pressure of fusing it, whereby the potash content in the material under treatment is converted into phosphate of potash. This phosphate of potash is then leached out and filtered off, in an aqeuous solution, from the insoluble matter or residue which consists almost, if not entirely, of alumina and silica. It is next evaporated to a syrupy consistency and sulphuric acid is added (or any other suitable acid or acid radicle) by which the phosphate of potash is converted into the crystalline sulphate of potash or other salt of potash desired, leaving the phosphoric acid free to be re-used in treating fresh feldspar or other potash containing material. The alumina and silica are readily separated and are sold as alum, sulphate of alumina or alumina itself and fine pure white silica. There are many uses for these by-products which at present prices, even, render the process a very remunerative one. The operation of the phospho-potash process does not involve any but the usual chemical devices, such as are in general use in heavy chemical plants. The cyclic procedure, in that the powerful reagent—phosphoric acid— is re-used repeatedly, places this method on a more economical basis than others which require fresh stocks of reacting chemicals, and is thus unique in this respect.

The process has been demonstrated upon a small commercial scale with extractions varying from ninety-five to almost one hundred per cent. efficiency, and is equally effective in the treatment of low grade silicates, such as are often to be found around feldspar quarries. Very pure salts of potash have been readily obtained, this being specially desirable as the profits in manufacturing same are greater even than that derived from low-grade salts, as are utilized in the fertilizer industry.

ONTARIO'S MINERAL PRODUCTION.

Ontacio May Surpass California in Gold Production During 1921.

The feature of Ontario's mineral production during 1921 is the growing importance of the gold mining industry in that province. Returns for the year are not complete as yet, but provided the output for the last quarter equals that of the third quarter, the output of gold in Ontario for 1921 will be approximately $13,870,000, or with the exchange premium added, $15,200,000. Ontario now leads all the other provinces in gold production and it is possible that the 1921 production will exceed that of California, which contributes about 75 per cent. of the total gold output of the United States.

The estimated value of Ontario's mineral production for the nine months ending September 30, 1921, is $20,994,000, compared with $35,920,000 for the same period in 1920. The falling off is largely due to decline in nickel and silver production. The production of nickel matte for the 1921 period was 2,908 tons, as compared with 17,446 tons for the corresponding nine months of 1920. The production of silver for the 1921 period was 6,586,910 ounces, as compared with 7,831,143 ounces for the similar 1920 period.

INDUSTRIAL MINERALS IN NORTHERN SASKATCHEWAN.

The second annual exploration party sent by the Government of Saskatchewan into the northern part of that province to explore the mineral possibilities of that region, returned recently after having examined in particular the features of one of the most promising districts that of the Bear Hills. Among the more important minerals discovered in the vicinity of the Bear mountains, according to a despatch in the daily press, were the following: "A wide variety of clays and shales, limestone, granite and sandstone for building purposes, small amounts of garnet sand, glass sand, builders' sand, large tracts of bog iron ore, numerous deposits of yellow ochre and other paint materials, and several springs of mineral water. That the north-eastern portion of Saskatchewan is rich in clay and shale deposits for the manufacture of building brick, paving brick and other lines of structural clay ware is clearly shown by the great beds of Benton shale to be seen at several points. There are exposures of this material ranging in height from 80 to 100 feet of pure shale, without a single band of non-clay material intervening, representing millions of tons of structural building material."

GOOD ROADS CONGRESS AT CHICAGO.

The Twelfth American Good Roads Congress and Thirteenth National Good Roads Show will be held at the Coliseum, Chicago, January 17-20, next. The Portland Cement Association, Chicago, Ill.; the Portland Cement Association, New York; and other organizations of road material producers are co-operating in arrangements for the Congress.

A Review of the Work of Ernest A. LeSueur

An Appreciation of His Contribution to Industrial Electro-Chemistry Through Research in the Design, Construction and Operation of Commercial Electric Cells.

By L. E. Westman.

ERNEST A. LeSueur* was born in Ottawa in 1869, and educated at Ottawa Public Schools, Ottawa Collegiate Institute, Mass. Institute of Technology, graduating in 1890 in electrical engineering.

In 1888, having previously done irregular experimenting in electro-chemistry, he commenced comparatively systematic work on the electrode-composition of solutions of the alkaline haloids.

Up to that time no satisfactory results had been obtained in this line. The success that LeSueur achieved is not to be ascribed to the fact that he found an unworked field in which to disport himself. Work had already been going on for forty years. The greatest authority thirty years ago was the late Ferdinand Hurter, consulting chemist to the United Alkali Co. In the summer of 1889 he read a paper before the S. C. I. which gives an excellent idea of the amount of work done up to that time and the many failures recorded. In it he clearly pointed out the chief difficulties which had to be solved if the business were ever to be placed on a commercial footing. It is to be remembered that the electro-chemical process was not adapted to subplying the market with new products but only to preparing substances which were already made in huge quantities by the Leblanc and Solvay processes.

In his address Hurter expressed his considered opinion to be that the difficulties surrounding the problem were of such a nature as not to be soluble commercially, and he suggested that he be listened to as one who had burnt his fingers.

LeSueur first directed his attention to the mercury cathode principle, and in the summer of 1888 built a cell with supported mercury cathode. The latter rested on a tough, porous fabric supported on a grating of paraffined wood strips. The anode consisted of moulded carbon rods cast into a lead backing, the latter being above the liquid and the whole having been treated with hot melted paraffine wax. Interesting results were obtained. In the first run no water or solution was placed on top of the mercury but, after six hours, the cell was found with liquid covering the mercury, and white grains, at first assumed to be salt precipitated by evaporation, resting on the mercury. LeSueur assumed that the layer of mercury must have divided, by reason of insufficient thickness, so as to allow brine from beneath to come up through, and he transferred a drop of said liquid to his tongue. The liquid was, unfortunately or otherwise, an oily solution of caustic soda, approximately 50%, and his satisfaction at discovering how well the cell had worked, was considerably tempered by a badly burnt mouth. It was an August afternoon, presumably with a fair amount of humidity, and obviously what had happened was that sodium, combining with the oxygen of a portion of the attracted moisture, had produced the solution.

The apparent great simplicity of the above method of employing a mercury cathode will be obvious. Instead of having by mechanical rocking (as in the Castner cell) or forced circulation of mercury (as in the Rhodin cell and others) to carry dissolved sodium out of the cell proper (the same means also acting to bring residual sodium fortuitously back again), the sodium in the above type of apparatus is put into the mercury on the under side of the supported liquid cathode and immediately moves (or the light amalgam containing it does) to the upper side of the same, thereby removing itself from further relation to the cell proper. Furthermore, the amalgams that are formed with such traces of alkaline earth metals as exist in the salt employed also escape automatically from the cell proper to a point where their presence is unable to set up local electrolytic action.

ERNEST A. LESUEUR.

In comparatively recent years much has been written about this general type of mercury cathode by authorities who appear to put themselves forward as having originated it.

By 1889 LeSueur came to the conclusion that, except for such limited business as might be done at relatively fancy prices for a c.p. product, the diaphragm process would be capable of showing far lower costs than the mercury or other liquid cathode cells (by the way, the molten lead cathode was very carefully considered in those days) and this view has since been eminently justified. In the above year he commenced work on the diaphragm type of cell and in 1889-90 ran a series of experiments on this type at M.I.T. in connection with his graduating thesis, "Investigation of the Method of Decomposition in a Certain Class of Electrolytic Cells."

The apparatus of his thesis was as far removed as could be imagined from anything commercially serviceable, or capable of being modified so as to be so. During the same period, however, and quite unknown to the Institute authorities, he developed a commercial electrolyser for the production of chlorine and soda products at a chemical works in Newton Upper Falls, a suburb of Boston. In this cell the essential principle was first employed of using an excess pressure on the anode side of the diaphragm, whereby such leakage as occurs will be of anolyte into the cathode compartment, which LeSueur ascertained to be unobjectionable, instead of the reverse, which is ruinous to the efficiency.

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* E. A. LeSueur has for many years lived and worked in Ottawa, maintaining a consulting practice and semi-commercial electro-chemical laboratories.

The cell of that date had a diaphragm relatively nonporous mechanically although porous molecularly. That is, it conducted electrolytic current like a wet membrane would do, but did not allow substantial flow of the solution unless some fault occurred. Later, a diaphragm was employed which permitted substantial transfusion of anolyte which swept before it alkali in the acts of diffusing and of being electrolytically transported into the anode compartment; and upon the double principle of maintaining pressure on the anode side of a suitably porous diaphragm, in other words, feeding the brine supply to the anode compartment, depends the present industry of electrolytic alkali manufacture.

The value of the products so far made by the above method has been not less than a billion dollars.

As can be imagined, the number of expedients that had to be adopted, in addition to the above basic process features, to give anything like commercial results with apparatus the predecessors of which had worked on a scale of a few amperes, and usually in stock laboratory vessels, was very large. They may be referred to as the rugged appurtenances of the modern electro-chemical plant. Space, however, forbids going into these at length.

Early Manufacturing Days.

A small demonstration plant of the original type of commercial cell was installed at Bellows Falls, Vt., in 1890-91. In 1892 ground was broken at Rumford Falls, Me., for the first regular commercial plant to use the process, and in '93 the first manufacturing commenced. LeSueur was considered too young at that time to have charge of operations and the gentleman who was made manager had views of his own as to the ideal type of apparatus and rebuilt the whole electrolytic portion of the plant which, while the essential LeSueur process features were necessarily retained, departed so widely from scientifically correct and practicably commercial design as to result disastrously in the various regards of efficiency, durability and balance sheet.

When all the money appropriated to the business had been exhausted, that is to say, early in 1896, LeSueur was offered a chance to see whether he could put the thing on its feet again with the assistance of a few thousand dollars which was subscribed jointly by his personal friends and by the Boston shareholders. There was no help for it but to take hold and do his best and a great improvement was at once made in the electro-chemical efficiency of the peculiar apparatus he found on the place, and the latter was gradually replaced by his own type.

There was, however, a serious shortage in working capital and the matter was made worse by the arrival of general hard times and a drop in the demand for, and the price of, the products. Although the output under his management, and without increasing the amount of power used, greatly increased, and ran well into the millions of pounds, the abnormal business conditions of '98 made it an up-hill fight. When, therefore, late that year, the Burgess Sulphite Fibre Company made an offer for the plant, with a view of making calcium hypochlorite solution direct, it was accepted and the outfit was transferred up the Androscoggin River to Berlin, N.H.

From the start it was a great financial success, and the identical plant, save for replacements, has been working there for the past twenty-three years, the only material change being that, when Acheson electrodes became available about the beginning of the century, they were substituted for an interesting type of platinum electrodes invented by LeSueur about the end of 1896. These latter employed so little platinum that they had successfully displaced LeSueur's own earlier rugged and cheap electrodes, made by casting a massive lead backing on the ends of fragments of selected retort graphite, which had previously been employed. These platinum anodes were called the "filamentary electrodes." They consisted each of about twenty wires 0.008 inch diameter and 4 inches long, which were flattened for about 3 inches of their length to about 0.001 inch thickness, so as to greatly increase the surface. The unflattened ends were sealed through the bottom of a vertical glass tubular stem of about 5/16" inside diameter and about 14" long. A few drops of mercury were placed in the bottom of this tube and made contact with the end of the platinum wires. A ¼" soft iron rod, about the length of the glass tube, was placed within the latter so that its lower extremity dipped into the mercury. The separate wires were bent at the point at which they emerged from the glass stem into a plane at right angles to said stem and spread like the spokes of a wheel. The current capacity of each such electrode was properly about eighteen amperes and they were connected in parallel for each cell by a very simple system. It was essential not to overload these, otherwise the heat developed by the passage of current through the wires where they were sealed into the glass caused cracking of the latter, escape of the mercury and opening of the circuit, thereby throwing a further overload on the remaining electrodes belonging to the same cell. Lack of funds at Rumford Falls had caused considerable of this trouble by insufficient platinum equipment, but this difficulty did not exist to any extent after the move to Berlin.

The Standard Cell of 1898.

The form of cell which became practically standardized in 1898 was of a current capacity, roughly, of 1,200 amperes and was contained in a tank of quarter-inch steel 5x9 feet by 18 inches deep. The materials of construction were mainly brick, portland cement, flat steel (about ⅜"x2½") wire cloth or perforated metal, slate and asbestos paper, the latter forming the diaphragm. This form of the LeSueur apparatus has an approximately horizontal diaphragm; that is to say, it only slants enough to permit ready escape of the hydrogen generated beneath it. A side elevation of the diaphragm resembles a "W," except that the vertical depth of the troughs is only about four inches and the length of the two troughs about eight feet.

This type of cell lends itself well for the collection of hydrogen, and, even before any practical use was made of this gas, the cells were provided with pipes which received it and from which it could be drawn. Hydrogen is now an important by-product in connection with its use for the hydrogenation of vegetable oils.

This apparatus was well described in the excellent paper by Prof. Chas. L. Parsons (C. S. J. XX 868). He commences with the flat statement:—"Ernest A. LeSueur enjoys the distinction of having invented the first electrolytic process for the production of alkali and chlorine which became a regular contributor to the markets of the world."

Duplications of Original Process.

Naturally there was extensive copying of the successful apparatus and process features developed by LeSueur, and this was especially notable amongst his employees who took jobs at Rumford Falls without any previous knowledge of the business—mostly, even, without any information as to what an electrolytic cell of any kind might be. These individuals, after seeing the LeSueur procession at work, went abroad in the land and installed cells embodying the LeSueur principles as well as many of his apparatus features in paper mill bleacheries and elsewhere. Among them were James Mercer, Frank McDonald, H. K. Moore, and one or two others.

Chas B. Barton, who was LeSueur's superintendent at Rumford Falls from 1896 on and went to the Burgess Sulphite when the plant was transferred, and who has now had twenty-seven years continuous experience in building and handling cells of many types, and whose ripe knowledge of theory and practice in this field is probably unsurpassed, read a paper in June, 1920, before the A. I. C. E. recorded in their Transactions, Vol. XIII, Part I, p. 5. In it he refers to the fact that all the original paths in connection with the successful electrolysis of salt appear to have started from the LeSueur plant at Rumford Falls. He says: "McDonald and Mercer were foremen of the cell houses in Rumford Falls. H. K. Moore had his first experience with cells in the employ of the Rumford Falls plant. The Nelson cell was born of experience with the McDonald cell, which was a copy of the third type of LeSueur cell."

Barton also says: "Unless I am greatly mistaken, the LeSueur patents were the foundation of all electrolytic porous diaphragm cells and credit should be given E. A. LeSueur as being the real founder of the industry."

The Perfection of Original Design.

What strikes one as especially remarkable is the fact that the Brown Company (successors to The Burgess Sulphite Fibre Co.) have not only retained the original LeSueur apparatus, but have increased enormously the number of units during the past twenty odd years in the face of careful investigation of the later cells. It was, therefore, not merely in the construction of a commercial cell which competed successfully with chemical processes at the end of the nineteenth century, but in carrying the practical design of this apparatus to a point which enables it today to show a commercial performance equal to that of any of the legion of new cells, with all their claims for modern superiority, which have appeared in the last twenty years, that LeSueur's achievement is remarkable. To do this involved departures from previously known practice in scores of particulars.

Patent Experiences.

The patent side of the matter was unfortunately defective, and this was due partly to LeSueur's inexperience and to his implicit reliance on his patent attorneys when his first applications were made. The following is quoted from some remarks of LeSueur's before the A. I. C. E., and are extracted from Trans. A. I. C. E. XIII, 9.

"While still in college I was put into the hands of a firm of patent attorneys who were highly recommended, and I believe they were excellent men in boot and shoe machinery, but what they did not grasp about the essential electrochemical points was considerable . . . What they did not accentuate was the fact, set forth in the specifications, but not properly claimed, namely that it was most desirable that there should be an excess of pressure on the anode side of the diaphragm. That, as I discovered in the early nineties, was only half of it, and the other half was that you must use a diaphragm which is mechanically, not merely molecularly, porous."

The trouble was, that once the correct fundamental working principles became known, even through publication in a patent specification, it was impossible to get patent protection on them. The following is a claim in one of his later patents in the field of brine electrolysis (applied for, nevertheless, over twenty years ago) which refers to the main fundamental principle in combination with a minor although very serviceable feature, which operated practically to diminish the osmotic activity of the catholyte. "The improved art of operating electrolytic cells having porous diaphragms which consists in feeding solution to be decomposed to the anode-compartment, maintaining a greater fluid-pressure on the anode side of the diaphragm than on the cathode side, whereby movement occurs of solution from the anode side through the diaphragm to the cathode-compartment, and feeding water to the cathode-compartment, said water having a lower temperature than that of the liquid contents of the anode compartment."

A basic patent (U. S. No. 583330) enabled the offsetting of diffusion of catholyte by the addition of hydrochloric acid.

The above is a rough outline of LeSueur's electro-chemical work through '98. Besides private consulting practice he has done much original work since in connection with chlorates and perchlorates by electrolysis, the liquefaction of gases, explosives, and in copper metallurgy, and a brief account of some of these will appear in the next issue.

MEETING OF FRENCH SOCIETY OF CHEMICAL INDUSTRY.

The Societe de Chimie Industrielle of France held its annual meeting in Paris, Oct. 9th to 12th. Members of the Government were very active in support of the work of chemists, both the Ministers of Commerce and Agriculture addressing members and visitors. A feature of the meeting was the exhibition of chemicals and machinery. The French chemical industries have been greatly expanded, and a very large range of interesting chemists gave addresses, and the whole meeting is reported to have been the largest and most successful chemical gathering yet held.

THE OLDEST LIVING THING.

A huge cypress tree in a churchyard near Santa Maria del Tule, in Southern Mexico, according to biologists who have made investigations, is believed to be the oldest living thing in the world, being between 5,000 and 6,000 years old.

This age is based on the gigantic bore of the tree and the slow growth of the species. The figures mean that when the seed from which the tree sprang fell upon the earth King Menes was holding the first reign in Egypt of which we have an historic knowledge, 3,000 years before the birth of Christ.

Humboldt discovered the tree more than 100 years ago. He nailed to the tree a wooden tablet containing his autograph and, although it is now partly hidden by the subsequent growth, the autograph is still legible.

Modern Developments in the British Brass Industry

By Ernest T. Smith.

(Concluded from our December issue).

Extrusion of Brass.

Closely allied to the casting of brass is the shaping of the metal by the extrusion process in which the hot metal, while in a more or less plastic condition, is forced by heavy compression through a die, from which it "extrudes" in the form in which the die has been cut.

In no section of the brass industry has development been more rapid in recent years than in the production of rods and sections by the extrusion process, which was invented by Alexander Dick and developed by the Delta Metal Co., Ltd. Before the war the extrusion process was little known apart from one or two British firms who had specialized in the process and brought it into almost everyday use. The methods adopted were jealously guarded and the knowledge of the process in actual practice was confined to only these few firms. As a result, however, of the imperative demand for a large and rapid production of brass bars, extrusion presses were fitted up and installed in many works to meet the demand; with the result that the use of extruded bars and sections received a great impetus. A number of firms having equipped their works with the necessary machinery for the process are now actively interested in the production of extruded material, and are giving the industry the benefit of their equipment and experience so that a considerable quantity is now being produced for industrial purposes. The demand for suitable presses for extrusion has been well met by British engineers, who supply hydraulic plant with 600 to 1,000-ton presses, capable of extruding brass bars up to 3 inches drawn from standard billets of 5.25-inch diameter by 24 inches long. Amongst the more prominent makers of extrusion plant are Messrs. Fielding & Platt, Ltd., of Gloucester, Henry Berry & Co., Ltd., Leeds, and Davy Bros., Ltd., Sheffield.

Brass of the ordinary 60:40 composition is most suitable for strong extrusion work and is the most widely used alloy, being soft and easily extrudable when hot. When alloys of other compositions are used they have to be governed by their capacity for "flowing" when heated for extruding. With an increase in the copper content the metal becomes harder and more difficult to extrude. A 600-ton press will satisfactorily deal with brass up to about 62 per cent., but larger presses are required for extruding metal of higher copper content.

Special brasses containing small percentages of other metals, such as iron, manganese and aluminum, to give additional strength, are also being extruded satisfactorily, the added metals having but slight effect on the extruding properties provided due regard is paid to the quantity added. The extrusion process has many advantages over the older methods of rolling and drawing, and there is every prospect that the process will be considerably extended in the future.

The ease with which sections, many of which are very complicated, can be produced by the process, practically to size, at one operation, together with the fact that sections can be extruded that would either be impossible or extremely difficult to produce either by rolling or drawing, no doubt largely accounts for the increased favor which the products of this method of manufacture are finding.[2]

The making of tubes and hollow sections are included in the newest applications of the extrusion process, the difficulties at first encountered in their production having now been successfully overcome.

So far as the manufacture of solid drawn brass tubes by the ordinary process of drawing is concerned there is little advance to be recorded in the actual appliances used, but manipulation has been modified in the light of modern research, especially in its relation to season-cracking, to which brass tubes drawn through a die are somewhat susceptible.

Hot Pressing and Forging.

Another section of the brass industry that has developed greatly during recent years, and is to-day of considerable industrial importance, is the manufacture of light parts by the process of pressing a heated billet to a definite shape in suitable dies. In some cases the metal is stamped cold, but the more general practice is to heat the metal to a suitable temperature before subjecting it to pressure. Brass of 60:40 composition has been found in general practice to give the most satisfactory results owing to its good forging qualities, but brass of other compositions is also employed.

Extruded rod is extensively used as raw material, though cast bar is used in many cases. The pressures employed vary from 70 to 400 tons, although 200 tons available pressure is capable of dealing with a large number of the articles manufactured in brass. The most suitable temperature for the hot-working of brass varies with the composition, and has been the subject of recent research. "It would appear that the work done during compression diminishes with increasing temperature from 500° C. onwards, at first rapidly and then more slowly. For copper, the work required at 800° is about one-third of that required at 500°, and the influence of temperature becomes more strongly marked in alloys containing 12 or 15 per cent. of zinc. For brass with 28 per cent. of zinc, the work at 800° is one-quarter of that at 500°, and for brass with 37 per cent. of zinc, one-tenth. In the last case three times as much work is required at 700° as at 800°. As soon as the *Beta* phase makes its appearance the work becomes less, and at 42 per cent. brass may be compressed at 500°, and the full softness is reached at 700°. *Alpha* brasses are therefore best worked at 800° C., higher temperatures being undesirable on account of burning. At this temperature, all the alloys examined undergo the compression of 50 per cent. without cracking. Most of them have been compressed 80 per cent. without cracking. The work required at all temperatures increases with increasing zinc content to a maximum at 15 per cent. of zinc and then rapidly diminishes to a very small value in the *Alpha Beta* region.[3]

The speed of working and the flow of the metal are important considerations in hot-pressing. The advantage of the die-pressing process is that the piece being produced under heavy pressure is very close grained and free from the defects such as blow-holes and pin holes, not infrequently met with in brass castings. They also have a smooth surface and no hard skin as in castings, and require little or no machining.

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[2] Metal Industry, No. 19, 1920, 17, 404.

[3] Journal Institute of Metals, 1921, 25, 398.

The machineability of brass is a matter of great importance, and has received a large amount of attention during the war period. Among the most important investigations on this subject may be mentioned that by C. H. Desch, who conducted experiments to ascertain why brass rods of approximately 60:40 composition had been found to give widely differing results on machining. He found that the presence of small percentages of metals other than copper and zinc changes the relative proportion of the alpha and beta constituents, and that the most desirable structure for machining purposes was an arrangement of fine fibrous alpha crystals separated by a comparatively small quantity of beta. This could be obtained by the employment of an alloy containing as nearly as possible 40 per cent. "apparent" zinc, i.e., with the added metals calculated to the equivalent quantities of zinc, and by the use of moderate temperatures and powerful presses in extrusion of the rods. It was found that brass of good machining quality should contain as nearly as possible 60 per cent. of copper and 1.5 per cent. lead, with a minimum percentage of other metals.

Rolling-Mill Practice.

Although there is no marked advance in brass rolling mill practice, a number of mills of improved design have been installed during the past ten years and better work is being produced than formerly.

Both in England and in America there is need for a much closer study of the factors which tend to soundness of ingots, which is of such vital importance in the production of sheets of high-grade quality.

The production of a superior finish to sheet brass is not, however, altogether a question of a sound ingot or of good rolls, important as these factors are, but is to a large extent dependent on the exercise of scrupulous cleanliness in all the details of the rolling operations. It would appear to be in this direction that improvement in British rolling practice is to be sought. One important factor that operates against the British sheet brass roller is that he is not generally able to confine his rolling to comparatively large orders of one class of material which are so conducive to economic production, and which pertain to most Continental rolling mills. More frequently he is called upon to supply small quantities of material varying in composition and gauge, which adds considerably to the cost of rolling and militates against superior finish when the same rolls are used for all classes of work. The speed of rolling varies with different manufacture and whether the metal is hot or cold rolled. The generally recognized speeds for cold rolling are approximately as follows:

	Ft. per Min.
Breaking down strips	20 to 40
Finishing sheets	60 to 80
Finishing sheets	80 to 100
Finishing rods	100 to 120

The amount of reduction given depends upon the material and the temperature of annealing. On breaking down mills of large sizes for non-ferrous metals generally very heavy pinches have been employed, being in some cases as much as ½-inch, but a common practice is ¾-inch. In the latter stages reduction from 2.5 to 1 gauge is still general. It is to be regretted that so little reliable data on the best conditions for brass rolling has been published.

Present day British practice is, to a large extent, based on empirical knowledge and there is urgent need for systematic research into all the factors governing the best economic operative conditions for rolling the industrial brasses, such as percentage reduction, number of passes to obtain given reduction, speed of rolling, amount of pinch in the initial stages, temperature of hot-rolling, etc., all such factors being studied in connection with the temperature and time of annealing.

Annealing.

For annealing purposes gas-fired furnaces of the close annealing type have been largely introduced in place of the old open bed coal-fired furnaces, and the temperature controlled by pyrometric observations in compliance with the more exact knowledge on heat treatment resulting from modern research. The installment of modern furnaces has considerably lessened oxidation during the annealing process and in consequence reduced the cost of manufacture through obviating the necessity of removing excessive scale. In this connection it may be pointed out that in several instances salt baths have been introduced for annealing small brass articles with considerable success and reduction in finishing costs.

The average gas consumption per 100 lb. of metal annealed, including gas used for preliminary heating of the furnace, and town gas of net calorific value of about 500 B.T.U. is given by Hartley as follows:

Nature of Work	Gas Consumption in Cu. Ft. per Cwt. Metal Annealed
Light brass stampings	100 — 125
Heavy brass stampings	150 — 200

The temperatures employed for annealing, and the time required to complete the operation, are, of course, dependent on the composition and nature of the metal to be treated, but it may be stated that much closer attention is now being given to this operation, with the resnlt that there has been a considerable improvement in the subsequent mechanical treatment and finishing of the material.

Composition of Industrial Brasses.

The figures given in the accompanying Table I may be taken as representative of the composition of the bulk of the ordinary brasses now being manufactured for industrial purposes, and of which thousands of tons are prepared annually. The extended use of brass for engineering and electrical purposes in recent years has resulted in a considerable development of the brass trade, but now that the enormous demands for brass for war purposes has ceased, manufacturers are earnestly seeking new uses for the metal so that production may not have to be curtailed.

TABLE I.

Approximate Composition of Brasses.

Trade Names	Percent Copper	Percent Zinc	Uses.
Brazing Metal	66-67	34-33	
Brass for extrusion and hot-pressing...	60	40	
Brown Metal	87-88	13-12	For buttons, badges, etc. The metal polishes to a golden color.
Cap Metal	97	3	For shell-caps.
Best English Brass (Cartridge Metal) .	70-72	30-28	For deep stamping and drawing, brazed tubes, etc.
Dipping Metal	73-74	27--26	For articles that require strong brazing or hard soldering.
Enameling (Tombac Gilding)	92-93	8-7	Used in jewelry and art metal trades. Enamels well.

Trade Names	Percent Copper	Percent Zinc	Uses.
Gilding Metal	90-91	10-9	
Ordinary Brass (Yellow Metal) (Muntz Metal)	60 62	40 38	Sheets, tubes, etc.
Princess Metal Tombac Brass, (Similar Metal) ..	81-82	19-18	Sheet, wire, etc.
Solder	50	50	
Stamping Metal	65	35	High class deep stamping alloy.
Turbine blading	70	30	For low pressure steam.
Wire Brass:			
Ordinary Brass Wire	62-63	38-37	Weaving, cutting up in automatic machines, etc.
Better quality	64-66	36-34	
Brazing Wire	70	30	
Solder	73	27	
Union Wire	75-81	25-19	
Gilding Wire	90	10	Used by weavers in fine sizes.
Spring Wire	95-98	5-2	

Considerable attention is being given to the development of the so-called high tension brasses for engineering purposes in which enhanced properties are conferred on ordinary brasses by the addition of comparatively small quantities of metals such as nickel, manganese, aluminum, etc. Many of these are very complex in composition and the exact influence of certain added metals is not completely understood, and their presence in some cases is of doubtful utility. To obtain the best results with these special brasses, improved knowledge of the true effects of the added metals is desirable so that endeavors may be made to simplify their composition.

The main object sought in the addition of other metals in commercial complex is to produce alloys, which, in the cast state, have a much improved yield point and maximum stress and increased hardness, with at least no serious loss of ductility; and when rolled and forged, a still greater improvement in mechanical properties, as shown by tensile tests. It is difficult, however, to say exactly how much of such improvements are due to any particular added metal. Heat treatment is advocated in some cases, but experience appears to show that it lowers the elastic limit, and not, as in the case of steel, actually raises it. The complex composition of the special brasses in general use is illustrated by the examples collected in the above Table II, by O. F. Hudson. Examples of mechanical tests obtained with these alloys are also given in Tables III and IV.

TABLE II.

Composition of Special Alloys.

Alloy	Cu	Zn	Sn	Pb	Fe	Mn	Ni	Al
Aich's Metal	60.0	38.0	...	...	1.8	...	...	...
Sterro Metal	55.5	42.0	...	...	2.5	...	...	...
Sterro Metal	55.0	42.4	0.8	...	1.8	...	...	...
Delta Metal	60.0	35.5	1.75	1.4	0.75	...	...	...
Delta Metal	55.0	43.5	...	0.4	1.1	...	...	...
Delta Metal	58.3	39.0	0.06	0.15	0.13	0.14	2.2	...
Manganese Bronze ...	69.0	24.2	...	1.6	...	0.25	...	4.9
Manganese Bronze ...	58.5	38.5	1.4	...	1.6	0.02	...	...
Manganese Bronze ...	56.2	40.5	1.2	0.4	0.4	1.1	...	0.2
Manganese Bronze ...	56.0	39.6	1.2	...	1.1	trace	2.0	0.1
Manganese Bronze ...	54.9	41.7	1.4	...	1.2	0.5	...	0.4
Aluminum Brass	61.0	35.3	...	...	1.0	0.5	...	1.5
Iron-Nickel Brass	54.1	38.0	...	0.42	2.5	0.9	3.6	0.4

In addition to these it may be mentioned that several firms that have made a specialty of high strength brasses are now producing an alloy containing about 4 per cent. of manganese which gives from sand castings:

Tons per Square Inch Elastic Limit	Tons per Square Inch Tensile	Elongation on 2 inches
22.0	42—46	15-20 per cent.

The alloy is largely used for propeller blades, etc.

The special high tenacity brasses present a wide field of useful research, not only on the constitution of brasses with one or more added metals, but on their mechanical and working qualities. Doubtless a large amount of information on this subject has been accumulated by manufacturers and others as the result of experience, but much of it is not at present or likely to be generally available.

Treatment and Utilization of Scrap and Residues.

The enormous quantity of brass scrap which has accumulated as the result of the war has brought into prominence the question of the economic treatment and utilization of this class of material. Whilst a large proportion of the scrap from war material is of a more or less special nature, every brass foundry and every firm concerned in the manufacture of brass produces a certain quantity of heavy and light scrap turnings, swarf, etc., and by-products such as ashes and skimmings, all of which have to be dealt with, and the way in which it is handled is a fairly good index to the efficiency of the works.

Most firms utilize their own heavy and clean light scrap, a certain proportion being added to each melting charge, and some foundries use certain of their own by-products. The majority of firms, however, find it is more economical to sell all by-products to a scrap dealer or smelter. Whatever the nature and quantity of the scrap material may be it is now generally recognized that a rigid system of collection and classification is of fundamental importance in its economic treatment, whether utilized in the foundry or works producing it or disposed of to outside dealers.

During recent years there has been considerable development in the treatment of scrap on more scientific principles and new appliances have been introduced to facilitate such treatment. Amongst these may be mentioned: disintegrating machines for disintegrating bulky turnings or swarf; magnetting machines for removal of iron; briquetting machines for compressing turnings or swarf; annealing furnaces for softening "springy" brass scrap; bundling or bailing presses for compressing sheet scrap; gas-fired furnaces for sweating tin and solder off light scrap; hydraulic presses for compressing or collapsing cartridge and shell cases.

TABLE III.

Mechanical Tests of Special Alloys.

Alloy	Composition Cu	Zn	Fe	Mn	Ni	Al	V	Tensil Tests Condition	Yield Tons Sq In	Max. Stress Tons Sq. In.	Elong. Percent on 2 in	References
Delta Metal	...	...	...	...	...	...	...	Square bar annealed	...	27.8	38	Law
	...	...	...	...	...	...	...	Flat plate annealed	12.1	30.0	36	"
	...	...	...	...	...	...	...	Flat plate	13.7	35.4	14	"
	...	...	...	...	...	...	...	Round bar	23.4	32.1	23	"
	...	...	...	...	...	...	...	Hexagonal bar	25.0	31.3	11*	"
Manganese Bronze ...	58.8	38.1	0.8	0.7	.	1.2	.	Cast (?)	13.6	24.2	22	Norris
Manganese-Vanadium Bronze..............	58.6	38.5	1.0	0.5	. .	1.5	[illegible]	Cast (?)	22.6	36.4	12	"
Vanadium Bronze ...	...	...	.	...	. .	. .		Cold drawn, ⅝ in. rod	35.7	41.1	11.5	"
Nickel-Iron Brass	54.1	38.0	2.5	0.9	3.6	0.4	Pb [illegible]	Chill cast	13.2	32.5	43	Millington
								Sand cast	11.6	23.7	13.5	"

*Broke in ext. mark.

Ashes, sweepings and other by-products are usually crushed in a ball mill or similar appliance, the crushed material classified, and the metallic portion separated from the waste by passing over a concentrating table of the Wilfley type. Old crucibles are crushed and the larger pieces of metal picked out by hand or by screening, whilst the remainder of the material is put through the concentrator and the fine metallic portions collected and dried and then sent to the metal store for further treatment and analysis.

The question of dealing with brass scrap, to get it into a suitable form for melting has received considerable attention within recent years. A method which was developed during the war period and has been successful consists in mixing swarf with a certain proportion of fluxing material, and compressing into briquettes, ready for melting. A number of specially designed machines have been introduced to compress the material into a compact form ready for charging into the crucible. Powerful bundling or baling presses are in use where large quantities of bulky scrap sheet brass have to be dealt with. These machines, which are usually hydraulically operated, press the material into bundles or bales of an average size of about 30 by 18 by 6 inches, which are subsequently melted in small reverberatory furnaces.

Very small or fine material is frequently charged into metal cases, such as cartridge or shell cases, and the whole subsequently compressed in a suitable press. This procedure greatly facilitates the melting of fine material and considerably reduces the melting losses.

With regard to heavy scrap which is usually returned direct to the foundry for melting, experience during the war has shown that, where careful selection has been exercised, charges made up entirely of scrap have given castings and ingots equal in quality, and in some cases of superior quality, to that made from virgin metal either alone or with the addition of small percentages of scrap. This experience has modified the generally accepted conclusion prevalent before the war that not more than about thirty per cent. of scrap should be added to any charge. Whilst much necessarily depends on the class of heavy scrap available, and the nature of the work for which the metal is required, there appears to be little doubt that a few carefully conducted experiments made under suitable works conditions with the material available would prove that in many cases a much larger percentage of scrap might be employed than at present with economic advantage.

Provision for Research.

Although research has been active during the past decade in dealing with the internal structure of the brasses and their behavior under mechanical and heat treatment, and much knowledge of practical value has been gained, it is generally agreed that there is still urgent need for more intensive research in the future interests of the brass industry. This urgency facilitated the recent formation of the British Non-Ferrous Metals Research Association, which was incorporated in January, 1920, and has for its object the prosecution of scientific and industrial research relative to the production, treatment and uses of non-ferrous metals generally. At the same time it endeavors to disseminate existing knowledge amongst manufacturers by means of a bureau of information and the periodic publication of a bulletin.

The Association seeks to co-ordinate and to co-operate in all researches being conducted on non-ferrous metals and alloys, and to initiate special investigation into problems that are of fundamental importance to the various industries concerned.

With regard to the brass industry the Association has already conducted researches relative to the casting of brass and its properties and reports have been issued to members. Further research on the causes of red stains produced in the manufacture of sheet brass and other sujects is now in progress. Manufacturers are encouraged to bring their problems before the Association and to suggest researches that will be of value to the industry. These after the consideration and sanction of the council in conjunction with the special research committees are taken in hand as far as the available funds of the association permit. For the immediate future the most pressing subjects awaiting more exact knowledge appear to be those connected with the economic melting and casting of brass and its mechanical and heat treatment during the numerous processes of manufacture.

In the brass foundry a good deal of information is really necessary which can only be obtained from systematic practical research, which has not yet been adequately done. Amongst the factors of importance in the melting and casting of brass ingots may be mentioned, the design of the furnaces, particularly adequacy and constancy of pull of the flue; laboratory supervision of quality of fuel, particularly in coke-fired furnaces; adequate protection of the metal during melting to prevent oxidation and ingress of gases; rate and method of pouring; shape and thickness of mould, its position and temperature during casting.

At the present time there is little exact knowledge available as to the correct casting temperature, and the best conditions of casting for the various qualities of brasses in use for industrial purposes. As previously pointed out electrical melting offers great possibilities, and the conduct of carefully planned investigations from the point of view of general foundry conditions and requirements would be of extreme value to the industry. The exact conditions that govern the economic rolling, stamping and hot-press-

TABLE IV.

Mechanical Tests of Special Alloys.

	Composition								Tensile Tests				
Alloy	Cu	Zn	Sn	Pb	Fe	Mn	Ni	Al	Condition	Yield Pt. Tons Sq. In.	Max Stress Sq. In.	Elong. Percent on 2 in.	Reference
Delta Metal	60.0	35.5	1.75	1.4	0.75	...	...	..	Square bar annealed	...	27.8	39	Law
	55.0	43.5	...	0.4	1.1	...	...	...	Flat plate annealed	12.1	30.0	36	"
	58.3	39.0	0.06	0.15	0.13	0.14	2.2	...	Flat plate	13.7	35.4	14	"
	...	...	...	...	...	...	...	.	Round bar	23.4	32.1	23	"
	...	...	...	...	...	...	...	...	Hexagonal bar	25.0	31.3	11*	"
Manganese Bronze ...	58.8	38.1	...	...	0.8	0.7	...	1.2	Cast (?)	13.6	24.2	22	Norris
Manganese-Vanadium Bronze	58.6	38.5	...	...	1.0	0.5	...	1.5	Cast (?)	22.6	36.4	12	"
Vanadium Bronze ...	...	...	...	...	...	...	...	...	Cast	12.1	31.7	32	"
Nickel-Iron Brass	54.1	38.0	...	0.4	2.5	0.9	3.6		Cold drawn ⅝ in. rod	35.7	41.1	11.5	"
								0.4	Chill cast	13.2	32.5	43	Millington
									Sand cast	11 6	23.7	13 5	"

*Broke in ext. mark.

ing of different qualities of brass also require further investigation. New uses for the industrial brasses now in general use are urgently needed and research might well be devoted to an attempt to solve this problem which is so necessary to the future welfare of this important national industry.

Reference has already been made to the increasing attention that is being given to the so-called high tenacity brasses and the need for further research in this direction. Engineers are urgently needing brasses that will withstand service at comparatively high temperatures and under high pressure, and there is a promising field for research in this important branch of the brass industry. Considerable attention has been given in recent years to the production of non-ferrous acid-resisting alloys, and in this connection there appears to be scope for further research work on the addition to brasses of other metals such as titanium and the less known metals, with a view to attaining the object in view.

Problems await solution in connection with the extrusion of brass, as for example the prevention of the "coring" which frequently takes place in bars manufactured by this process. More exact and scientific information is required on the question of soldering and brazing and the composition of the alloys used. Stronger solders are required to meet the more exacting demands of modern engineering practice.

Such in brief are in the author's opinion some of the more urgent problems that await solution in the brass industry. Whilst it is true that a large amount of data relative to these various problems has been accumulated in recent years much of this is of little value to the manufacturer owing to the lack of essential details and the unscientific manner in which the investigations have in many cases been carried out. If they had been carried out with due regard to the objects for which the metals and alloys are to be applied in industry the results would probably have been of much greater value. It is now fully recognized that research, the object of which is the acquisition of new knowledge, is a fundamental necessity to progress, consequently the future development of the brass industry will largely be dependent on the extent to which it encourages research and undertakes investigation on its own behalf.

Organization and Co-operation.

One of the great lessons that has been learned during the war is the magnificent result of organization and improved methods of intensive manufacture. This lesson has not been lost on manufacturers in the brass industry and during the reconstruction period they have considered what is necessary to be done to make their production more efficient. It has been realized that the solution to progress in industry consists in improved methods of manufacture, improved organization, standardizing processes and reducing the cost of output. There were indications of a desire amongst firms in the same trade to organize, each firm specializing in parts, and progress in this direction has been made. The question of cheapening production in the brass industry by a system of amalgamation, standardization and concentration was brought prominently before manufacturers three years ago by the publication of a pamphlet on a "Scheme of Syndication for the Brass Industry," by Howard F. Smith, of Birmingham.

It is generally agreed that in the past and even at the present time a great source of wasted energy is that so many manufacturers are engaged in a miscellaneous trade, with no economic standards. Ten firms may each be manufacturing ten different types of articles at a loss, whereas, if each concentrated their attention on one type, the loss would be converted into a profit. That an economic limit of production should be established in each case is obviously a necessity, but the economic unit is not necessarily large. For example, it was proved during the war that many small firms were capable of manufacturing shells at least as cheaply as the largest orgniztions. These factors have been duly considered in the light of modern industrial requirements with the result that there has been a number of combinations of small groups of firms interested in particular sections of the brass industry. Such combinations are greatly to the interests of the industry as they abolish competition between the firms themselves and enable them to compete successfully in the world's markets. Combination in the brass industry presents some difficulty however, owing to the diverse nature of its products. Firms so diverse for example, as manufacturers of bedsteads, fenders and general household metal work, on the one hand, and brass tube makers and wire-drawers on the other, are illustrative of the great diversity of trade in Birmingham.

Another important factor bearing on the question of economical standards is the sad neglect of standardization of types, and the unnecessary variations that have been allowed to intrude themselves, merely to satisfy individual tastes, and because it has been nobody's business to see that they are reduced to a minimum. This question of standardization is one of considerable moment to the future of the brass industry, and it is gratifying to know that it has now been taken in hand by the British Engineering Standards Committee, which hopes in due course to issue specifications to cover all the varied uses to which the brasses are applied in industry. When these are issued they will no doubt lead to the discontinuance of a number of alloys now in use and greater co-operative effort in the efficient and economic production of the accepted standard alloys, the value of which was emphasized during the war period.

From what has been stated in the foregoing pages it will be evident that considerable progress has been made in the British brass industry during the past decade and that manufacturers as a whole are awake to the fact that the industry has now entered upon a new era of its history. Consequently they are taking steps to effect the reconstruction that is so vital a necessity if the industry is to maintain that position in the world's markets which the high quality of its products has secured for it in the past.

PERSONAL.

Mr. H. J. McAdie has resigned his position as sales manager of the A. Ramsay & Son Company, Montreal, having entered a business of his own as a direct agent and exporter. Mr. Ramsay will represent English, American and Canadian firms supplying the rubber, paper and other industries. Mr. McAdie's office is situated at 816 Power Bldg., Montreal.

THE NEW CANADIAN "NICKEL."

On January 3rd the first of the new Canadian "nickels" were made at the Royal Mint, Ottawa. They are the same size as United States nickels, but are made of pure nickel entirely, whereas the American nickel is only 25 per cent.

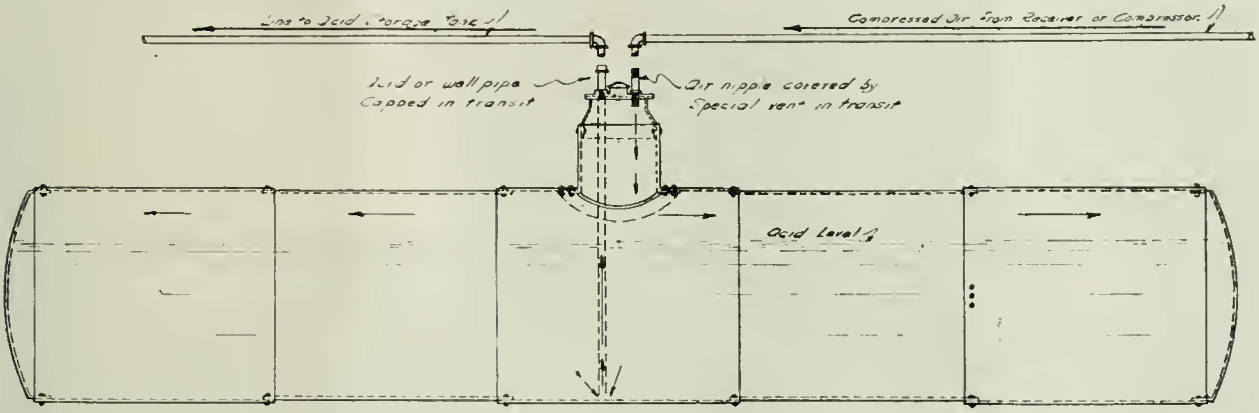
Handling Sulphuric Acid in Tank Car Shipments

By GERALD A. FOOT.

IT has been the writer's experience to learn that a misapprehension exists among many manufacturers with regard to the handling of sulphuric acid in tank car lots, and, it is for the benefit of these that this article is contributed.

While it is true that a justifiable abhorrence of this commodity is induced by its deleterious action on the skin, nevertheless, when the necessary precautions are observed the unloading of a car is a simple matter. It is not improbable that there are many companies now using acid who could handle economically large quantities at one time by introducing a proper storage and dumping system.

If the reader will study the accompanying cut, he will observe that the domes of tank cars are equipped with two pipes. The one extends through to the bottom of the car and it is through this pipe that the acid is forced to the storage tank. The other projects only slightly through the dome cover and to this pipe a compressed-air line is connected.


Line to Acid Storage Tank
Compressed Air from Receiver or Compressor
Acid or well pipe Capped in transit
Air nipple covered by Special vent in transit
Acid Level

When a tank of acid is received, the acid pipe will be capped and the air pipe will be covered with a special vent fitting. It is necessary to remove both the cap and the vent, but first unscrew the vent very slowly so that, if there be any pressure within the tank, acid will not be splashed on the operator. Once, however, the vent is removed, the acid pipe may be uncapped and the air and acid lines, respectively, connected.

Occasionally, the acid or well-pipe becomes clogged by frozen acid or by sediment which collects at the bottom of the tank. Should this pipe be obstructed, run a small steel rod—three-eighth-inch diameter—through the pipe until it is clear. If this procedure fails to give the desired result, undoubtedly the safest method is to remove the well-pipe from the tank and clear it outside. Although a very small amount of water is sometimes poured down the well-pipe to free it from frozen acid, this is not advised as there is a danger of the well-pipe being eaten away altogether.

In handling sulphuric acid from steel tank cars to storage tanks ordinary wrought iron gas or steam pipe is used. Strong sulphuric acid will not visibly attack iron. Dilute sulphuric acid say weaker than 55° Baume will react on iron owing to the fact that sufficient water is present to dissolve the protecting coating, and thereby creating new surfaces for the acid to react upon.

The lead pipe or lead containers are required only for acid which is weaker than 55° Baume or 70% H_2SO_4.

When unloading sulphuric acid high air pressure is unnecessary unless the acid must be sent to a very highly elevated tank. Thirty-five pounds of air will blow 60° Baume acid to a height of approximately 40 feet or farther. High air pressure should be avoided as it has a tendency to open seams and start leaks around the joints of a tank.

As a matter of precaution it might be well to keep lights or sparks away from the dome of a tank car when it is first open for if any hydrogen should have been evolved it would, when mixed with air, be explosive.

It will be observed that tank cars are not equipped with bottom discharging for the simple reason that an opening in the bottom of a tank carrying acid may tend to leak and thereby weaken the tank itself which in time may result in the loss of its contents.

In case acid tanks develop leaks fine dry sand may be permitted to run down a pipe to cover the leak and in that way the loss may be temporarily held up until the tank can be emptied and washed out for repair.

Sudbury, Ont.

THE PREVENTION OF RUST ON IRON AND STEEL.

Although the new rustless or stainless steel is a general success and is sure of its market, there are cases where its use is not possible, although in many of them the prevention of rust is an absolute necessity. There is also the large number of instances where iron articles are already in use, and others where the fear of rust prevents its use. One of the best known processes of preventing rust is by the very paradoxic one of first producing it. It is well recognized that a coating of oxide treated in one or two different ways will prevent further rusting. This is the underlying principle in the browning of gun barrels, where the iron is first rusted by the application of acids.

Another application of this principle is by the well-known Bower-Barff process. In this the iron is heated to redness and a stream of air allowed to come in contact with it, when a coating of magnetic oxide is produced. The furnaces for doing this work are regulated to a fine degree and the process takes some time, but when finished further rusting becomes very unlikely in ordinary use, and all sorts of articles are now treated in this manner with success.

Both these processes are too complicated to be very cheap in first cost. Their economy lies in their success as effective rust preventers. Cheaper preventers are on the market, and some of them are fairly effective, but it is a mistake to think that the cheapest of all, common coal tar, is of any use for the purpose. This contains acids which attack iron and make this material more destructive than protective. If the acids are neutralized by combining other useful ingredients with the tar a cheap rust preventer may be easily made.

A Good Recipe.

Here is a combination of protective agents which makes a good and cheap coating for ironwork where it can be used. Take 1½ lb. of well slaked lime and one gallon of tar. To the latter add half a pint of coal-tar naphtha, and, after well incorporating, stir in the lime, thoroughly mixing all together. If the ironwork is heated to a temperature of 210 deg. Fah. and then at once dipped into this compound the protection from rust that will ensue will be real and lasting under ordinary conditions. To ensure success the iron must be clean and free from rust when so treated.

Painting ironwork is a preventive of rust only when certain conditions are complied with. First, the iron must be quite clean; secondly, it should not be at freezing point, the warmer the better up to about 100 deg. Fah.; thirdly, it must not be subjected, after painting, to the presence of sea air or any acid or moisture-laden air. The best ordinary paint to protect ironwork from rust is red lead mixed with boiled oil as a primer, and red oxide as a second coat. A more effective but a dearer second coating is amorphous graphite, ground up in a solution of rubber dissolved in hot linseed oil. Dissolution is aided by the addition of a little deodorized mineral naptha.

An excellent protective coating is aluminum paint, but it should not be forgotten that it is only a paint, however unlike one it appears. That means the iron must be clean before application and that a primer is necessary.

BLAST FURNACE GASES AS PLANT FERTILIZERS.

Experiments have frequently been made with the artificial feeding of plants with the carbonic acid gas constituting the main constituent of their structure. Nature, of course, supplies this CO_2, which is present in the atmosphere to the extent of 0.03 per cent., and it has been proved that plants grown in greenhouses the air of which was artificially impregnated with additional supplies of carbonic acid, have gained very considerably as the result, though at a cost entirely out of proportion to the value of the excess production of food products. A number of German scientists have, however, been working on this problem recently, and these have evolved a new practice which may develop into a useful method of increasing production of certain classes of plants. Instead of using on a small scale artificially prepared and expensive carbonic acid gas, the experimenters turn into their glasshouses and sown fields the waste gases of blast furnaces. These experiments have had so much success that special nurseries for carbonic acid gas-fed plants have been put up in connection with one of Hugo Stinnes's smelting concerns, the Deutsch-Luxemburg Co., at Horst, on the Ruhr; and more are planned. The result is an increase of plant-substance varying, according to the kind of plant treated, from 50 to 300 per cent. Dr. Riedel, the Horst experimenter, declares that the gases from a consumption of 1,100 tons of coke, used in smelting 1,000 tons of pig iron, are sufficient to produce 4,000 extra tone of edible plant matter; and he adds the calculation that as before the war about 15,000,000 tons of pig iron are produced in Germany, the extra yield—if actually obtained in this way—would far exceed the present crops.

ESTIMATING WORLD'S RUBBER SURPLUS.

After pointing out that whereas some experts predict that at the end of December, 1921, the available surplus of world rubber will be 50% of the normal yearly production, others give the surplus at 30%, a difference of 70,000 tons, the Netherlands Chamber of Commerce, New York, gives the following review of the world rubber situation.

The visible world supply at the end of June, 1921, was 305,000 tons. To arrive at the surplus we must deduct from this the normal stock on hand, in the factory and in ocean transit, and the ever-growing quantity required for future deliveries, a total of at least 185,000 tons. This leaves a surplus above all possible and predicted requirements at the end of June, 1921, of 120,000 tons. We now arrive at the following calculations:

Total visible world supply, end of june, 1921 ...		305,000
Estimated production first half of 1921:		
Plantation rubber	135,000	
Brazilian and wild	12,500	
	147,500	
Deduct restriction second semester	45,000	
		102,500
Total		407,500
Estimated consumption second semester, 1921......		120,000
		287,500
Deduct normal stock		185,000
		102,500
Visible world supply January 1, 1921		287,500
Production 1922 (50% restriction)		200,000
		487,500
Consumption 1922 (estimated)		300,000
		187,500
Normal stock required		185,000
Surplus December 31, 1922		2,500

The anticipated restriction by agreement between the principal producers does not, at this writing, give promise of going into effect. The result however, will be the same, as many planters will be forced by unavoidable circumstances to suspend production entirely, thus effecting the anticipated lessening of production automatically.

BRITISH INDUSTRIES FAIR, 1922.

The next British Industries Fair will be held in London and Birmingham between February 27th and March 10th, 1922.

The British Industries Fair is open to manufacturers in all parts of the British Empire and buyers from all over the world are attracted. It affords an excellent medium for bringing manufacturers in direct contact with buyers, as only bona-fide manufacturers are permitted to exhibit and buyers are admitted to these Fairs by invitation only. The general public are not admitted.

Full details regarding the Fairs can be obtained from H. M. Trade Commissioners at 248 St. James Street, Montreal; 260 Confederation Life Building, Toronto; or 610 Electric Railway Chambers, Winnipeg.

AMENDMENTS TO PATENT ACT.

Important amendments to the Patent Act of Canada have been made, including changes in the fees. Those interested should secure a copy of these amendments from the office of the Patent Examiner, Ottawa.

TORONTO MEETING A.A.A.S.

American Association for Advancement of Science Holds Annual Meeting.

The seventy-fourth meeting of this associated organization of scientists was held at the University of Toronto during the week December 27th-31st. The attendance was quite large, several hundred delegates being present from the United States. The University of Toronto and the Royal Canadian Institute were jointly responsible for the arrangements. The only previous meeting held in Toronto was in September, 1889, and the First Canadian meeting was in Montreal in 1857. E. H. Moore of the University of Chicago is President, and Burton E. Livingston of John Hopkins University, Baltimore, Permanent Secretary.

Three general evening sessions were held. In the opening session, Dr. L. O. Howard gave his retiring presidential address on "The War on Insects." On Wednesday evening, Prof. William Bateson, of the John Innes Horticultural Institution, Merton Park, Surrey, England, spoke to a very large gathering on "The Evolutionary Faith and Modern Doubt." On Thursday afternoon, Sir Adam Beck (just returned from the successful opening of the wonderful Chippawa Power Canal), spoke on "Hydro Electric Developments in Ontario."

Section C, which deals with Chemistry, met in the Chemical Building, under the Chairmanship of Prof. W. D. Harkins, of the University of Chicago. On Tuesday, Prof. S. W. Parr, of Urbana, Ill., gave his retiring address on "The Carbonization of Coal," and Dr. Saul Dushman, of the General Electric Co., gave a demonstration of some subatomic phenomena by models and motion pictures. Dr. Dushman also gave an important paper on "Diffusion Phenomena in Solids at High Temperatures," showing methods of study and results in cases of carbon diffusion through Tungsten, and some applications leading to the general question of the diffusion of metals in industrial work. A paper was also presented on the mechanism of the oxidation of SO_2 in the sulphuric acid chamber process. Absorption spectra were used to show compound changes in concentrated mixtures. The paper was presented by H. I. Schlesinger and A. J. Salathe, of the University of Chicago. Dr. W. D. Harkins developed some of the interesting work he has done on the relations of atom nuclei, showing how by plotting values for certain relationships, which can be determined by experimentation, the probable number of isotopes of elements may be demonstrated and decomposition products determined. This very lucid disposition of his own work and that of others set out present knowledge on these points most clearly.

Dr. A. C. Neish discussed the question of presenting the fundamental principles of Elementary Chemistry, outlining his methods at Queen's University. On Thursday, Section C met with Section B (Mathematics). Prof. J. C. McLennan gave his address as retiring vice-president, on the subject of "Atomic Nuclei and Extra-Nuclear Electronic Configuration." This was followed by a symposium on the Quantum theory.

On Friday afternoon, the chemists met with the plant physiological section, hearing a number of interesting new papers. Dr. D. R. MacDougall gave a paper on "Distensive agencies in living cells and a new form of artificial cell."

The oxidizing and reducing action of iron, in relation to Biological Chemistry was covered by G. N. Hopper. Several other short papers were presented, including one by Prof. W. Lash-Miller, on the "Physiological Action of a Number of Chemicals on Yeast." Dr. Miller was elected vice-president of the Chemical Section for 1922.

The Engineering Section, under J. B. Tyrrell, covered a wide field in their papers. Natural resources, water-power, ice formation, engineering standards, mining, industrial research, railway development, oil and education were discussed by leaders in these lines.

During the week, a number of dinners were held and every opportunity was given visitors to see Toronto and Canadian winter sports. On Friday evening, an Engineering Dinner was held in Hart House, attended by the President of the University, Sir Robert Falconer, and the Hon. H. Mills, Minister of Mines for Ontario, officers of the Association and many Canadian Government officials and geologists, as well as leading visiting and Canadian engineers.

A distinct feature of the gathering was the large display of scientific equipment and instruments, set up by various firms in the annex of Convocation Hall. During the week, many visitors examined these interesting displays. British, American and Canadian companies were well represented. The exhibits included the following:

1. Art Metropole, Limited, Toronto.—Equipment and Supplies for Engineers and Surveyors.
2. Beck Bros., Philadelphia.—Electrical measuring apparatus; a special exhibit of rheostats.
3. Central Scientific Company, Chicago.—Apparatus for scientific laboratories; De Kkotinsky constant temperature appliances; electrical equipment for physical, chemical and biological laboratories; special lecture table pieces; analyzed chemicals.
4. Canadian Laboratory Supplies, Limited, Toronto.—Representing: Barnstead Still & Sterilizer Co.; Thermal Syndicate, Ltd.; L. Oertling, Ltd.; Wood Bros. Glass Co., Ltd. Products of above firms and others, including laboratory equipment and glassware of Canadian manufacture.
5. Committee on International Auxiliary Language.—Literature relating to this branch of the work of the International Research Council.
6. Canadian Electro Products Co., Montreal.—Synthetic Organic products, made from acteylene, including glacial acetic acid, acetic anhydride, and various aldehydes.
7. Filmcraft Industries, Ltd., Toronto.—A working model of apparatus for investigating the action inside ball, rod and ore crushing mills; equipment adapted for special scientific investigations.
8. J. F. Hartz Company, Ltd., Toronto.—Representing Duroglass Co., Ltd. Special glassware and scientific instruments.
9. Instruments, Limited, Ottawa.—Representing the following British firms: E. R. Watts & Son, Ltd.; Cambridge & Paul Instrument Co., Ltd.; Negretti & Zambra; Ross, Ltd.; Barr & Stroud, Ltd. The exhibit included the leading products of these manufacturers, such as transits, levels, drawing instruments, thermometers, telescopes, lenses, cameras, pyrometers, gauges, electrical CO_2 recorders, prisms and mirrors.
10. McKay School Equipment Co., Ltd., Toronto.—Representing G. Cussons, Limited. Special Physics apparatus and technical equipment for educational institutions.
11. Ontario Department of Mines.—Metallic and non-metallic minerals of the Province, including some remarkably rich gold and silver ores.
12. Pathescope Picture Service, Ltd.—Educational films.

13. Isaac Pitman & Sons, Ltd., London.—Scientific Books.

14. Spencer Lens Company, Inc., Buffalo.—Microscopes, microtomes, delineascopes, spectrometers, refractometers; a new darkfield condenser.

15. Synthetic Drug Company, Ltd., Toronto.—Arsenical drug preparations; Salvarsan, etc. Demonstrating a new method of testing values by action on certain micro-organisms.

16. Taylor Instrument Company, Rochester.—Temperature measuring instruments.

17. Thwing Instrument Company, Philadelphia.—Portable radiation pyrometers; multiple recording pyrometers; a new paper tester.

19. University of Toronto.—Department of Astronomy: Model of telescope at Victoria, B.C. Dean Coleman: Water colours illustrating mountain forms and glacial tracks.

20. W. J. Westaway Company, Ltd., Hamilton.—Representing the Permutit Company. Demonstration of Zeolite water softening.

Chemical Society News

TORONTO SECTION, SOCIETY OF CHEMICAL INDUSTRY.

The first meeting of the year was held at Hart House, University of Toronto, on December 9th. Because of legislation coming up before the Ontario House at an early date, involving chemists and graduates in science generally, it was thought advisable to have some further open discussion and opinions from chemists who are members of the Society. Mr. M. L. Davies, who has been re-elected Chairman for the coming year, opened the meeting for discussion, following an enjoyable dinner in one of the private dining-rooms of Hart House. Prof. E. G. R. Ardagh outlined the development of the movement, and disclosed the fact that a very great deal of time and thought had been spent upon it by Prof. J. W. Bain, and himself, as individual chemists on the general committee of engineers. Unfortunately, they were able only to represent themselves, as there was no Ontario organization of chemists and the matter was Provincial.

A full discussion followed, in which Prof. J. W. Bain, Dr. H. van der Linde, E. T. Sterne, Dr. R. D. McLaurin, Prof. J. T. Burt-Gerrans, Mr. J. M. Dickson, Mr. W. H. Thom, Mr. L. E. Westman, Prof. G. A. Evans and Mr. J. H. Mason took part. Generally speaking, the feeling developed was that no particular harm, and much good, might come from the passing of proposed legislation regarding "Professional Engineering." It seemed that there was little possibility that industrial chemists would ever secure a monopoly of the word "Chemist," now one of the designations of a graduate of the College of Pharmacy. Properly trained pharmaceutical chemists would still be chemists and should remain so. The matter was in the hands of the public, in as much as anything else, and custom, along with education, would likely carry more weight than legislation. It was felt that no very active opposition would arise in individual cases, if retail druggists were requested to discontinue using the word "chemist" for advertising and window display writing, in the opening of new shops. Individual druggists, who had been approached, did not place much weight on the use of the word in an unqualified sense. It was not a matter of vital concern to the business what word was displayed.

It is anticipated that the passing of the Act will not interfere with the activities of any Society in a detrimental manner. The organization created would simply be sufficient to carry out the legal orders of the Act.

The program for the Session was outlined. It was proposed to hold a joint meeting with Section C of the American Association for the Advancement of Science, at the University of Toronto, December 27th. Dr. W. D. Bancroft will probably address the members in January, and Dr. C. K. Mees will address the February meeting. The local members of the Canadian Institute of Chemistry will have charge of the March meeting. Specific dates for these have not been set.

The Committee for the Session consists of:
M. L. Davies—Chairman.
E. Rothwell—Secretary.
Prof. J. T. Burt-Gerrans—Treasurer.
L. T. Acton, L. E. Westman, G. N. Hill, G. C. Benson, W. C. Klotz—Committee.

BOOK REVIEWS

"THE RIDDLE OF THE RHINE."

By Victor Lefebure; W. Collins Sons & Co.; 278 p.p. Price, $2.75.

It is really a remarkable fact that the fundamental changes in warfare, brought about by the use of chemicals directly, have had such a minor effect on the views of the average layman. Governments still argue about the matter, as if something could really be done about it, and as if they, by mere talk, could prove that very little water had gone by the mill. From the Canadian viewpoint, we have not learned the lesson at all. We have no organized branch of the Canadian Militia concerned with chemical warfare as such. Even in England and the United States, it was with the greatest difficulty that a few men were able to retain small scale residues of the organization, which without doubt was a most important factor in the past struggle, and may well be the only factor in future hostilities. While the proper aim of nations is to seek peace, it is ridiculous to neglect obvious lessons in the art of warfare.

Major Lefebure has placed before the public a book which should do much to clear away the old order of ideas and issue in the war. His opportunities for observation were of the best and the material available after the war has been well worked up. This is about the first really satisfactory book that has come out on chemical warfare, and it has been widely received abroad. The average chemist will read it with great interest, as it sets forth the organizations operating on both sides, and gives in full the history of their development and the results obtained by various substances and methods of use. To the layman who has not as yet really connected chemical works with marching troops, the book will give an impression which should surely explain the great importance that was placed on these developments. These facts of chemical warfare should be the common property of all chemists and constitute perhaps the principal reason for the rising general appreciation of the function of the chemist in the national life of any people.

THE MINERAL INDUSTRY DURING 1920.

By G. A. Roush and Allison Butts; 907 pp. McGraw-Hill Book Co. Price, $10.00.

This is the annual review of technical and trade developments in the mineral fields of the world, and constitutes the twenty-ninth number in this series. Each chapter is the work of someone, very familiar with the particular field covered.

All the important minerals are reviewed, and chapters on Petroleum and Natural Gas, Cement and Coal are added. Wherever new developments have been undertaken or metallurgy has been advanced during the period, a full account is given. The whole series forms a most valuable history of mining and metallurgy, and this 1920 volume covers events during a time which represented the peak of world production in many lines.

TWO RISING CHEMISTS

WILLIAM H. THOM.

William H. Thom, Phm.B., B.Sc., a well known Toronto member of the Society of Chemical Industry, has been elected a director of Lyman Bros. & Co., Ltd. In his new position he will act as assistant general manager of this company. Mr. Thom was a member of the Canadian Council of the above society for a number of years. He was born in Paris, Ontario, receiving his preliminary education at Watford. In 1893 he went to London, England, where he began his career in the drug business. In 1900 he returned to Canada and in 1903 graduated from the Ontario College of Pharmacy with honors. Not content with this, he entered the Faculty of Applied Science at the University of Toronto in 1907, giving up the retail drug business. Here again he graduated with honors, in 1910, and as chief chemist immediately joined the firm of which he is now a director. While at the university he was instrumental in organizing the Chemists' Club, which dates from 1909. This has since grown to be one of the most active undergraduate organizations. Mr. Thom is to be congratulated on the progress he has made in his profession and his business advancement.

WILLIAM H. THOM.

JOSEPH HARRIS, M.P.

Mr. Joseph Harris has, through his recent election to Parliament, brought distinction to himself in more ways than one. We believe him to be the first chemist or chemical engineer to attain such a public office in Canada. Mr. Harris is yet just nicely entering the thirties, being a 1910 graduate of the University of Toronto in the Faculty of Applied Science, specializing in chemistry. He has maintained a keen interest in chemical affairs as a member of the Toronto Section of the Society of Chemical Industry, and has developed the business of which he is now general manager, W. Harris & Co., Ltd., glue manufacturers, along the lines of his university training.

JOE HARRIS, M.P.

We take pleasure in congratulating the new representative of East York at Ottawa on his election, and feel sure that the chemists of the Dominion will be glad to know that one M.P. at least can represent their interests with a complete understanding of their place in modern industry.

PERSONALS.

E. A. Allcut has been appointed Associate Professor in the Department of Thermodynamics, University of Toronto. Professor Allcut is a graduate in chemical engineering from Birmingham University, and has had considerable industrial engineering experience in England. He has been connected with the Smethwick Municipal Technical Institute, W. & T. Avery, Ltd., and The Austin Motor Co.

J. A. Dawson, Public Analyst, connected with the Dominion Government at Vancouver, was a recent visitor in the East, representing the Western interests of Civil Servants through the Prof. Inst. of C.S.C.

R. I. Hendershott has been appointed Canadian manager for Merck & Co., manufacturers or reagent chemicals. Mr. Hendershott comes to Montreal from New York and has had considerable experience in the chemical trade there.

Mr. Richard Coleman late chief metallurgist for the International Nickel Co. of Canada at Sudbury, Ont., has commenced a consutling practice at Sudbury, specializing in ore assaying and metallurgical work.

OVERSEAS AND FOREIGN INDUSTRIAL NEWS

ANNUAL REVIEW OF BRITISH CHEMICAL AND ALLIED INDUSTRIES, SPECIALLY PREPARED BY OUR LONDON REPRESENTATIVE.

THE BRITISH CHEMICAL INDUSTRY IN 1921.

The year 1921 has been both in Canada and the United Kingdom one of the most trying periods in recent economic history, and it is doubtful whether any industry has gone through worse difficulties during the twelve months than have the chemical and metallurgical trades. The year opened with a slump in trade, quickly followed in the United Kingdom by the premature decontrol without reorganization of the coal mining industry, resulting in a strike of the miners against an over-steep drop in wages. The effects of the coal stoppage introduced chaos and heavy loss into practically every branch of manufacture. The chemical industry, being a heavy user of coal both for power and as a raw material, was an obvious sufferer and the revival expected upon the return of the miners to work failed to materialize by reason of the collapse in the European exchange rates; the closing of normal sources of raw material; the imposition of heavy customs duties by many countries seeking to protect their domestic industries against imports from the ruined countries of Europe; and lastly as the result of the swollen exports from Germany of chemical and other products necessitated by the reparation scheme now in force under the provisions of the Versailles Peace Treaty.

The tendency of finished chemical products has been almost consistently in the direction of lower prices, though the end of the year reveals evidence of coming improvements in both demand and price. The effects of the Safeguarding of Industries Act, though extremely prejudicial to numerous trades, are believed to have been beneficial to the British fine chemical and dyestuff manufacturers, and the market for heavy chemicals also revived towards the end of the year. So far as the heavy branch of the industry is concerned, the slump in trade has been keenly felt, the largest salt producer in the country having had only 45 pans in operation in April 1921, as against 245 in April, 1920. Only the quality of the British product preserved the export trade from entire collapse in the face of extremely close German competition, particularly in the Indian market, and the coal strike produced a state of affairs from which complete recovery had not been made at the end of 1921. So far as sulphuric acid is concerned, most works were entirely closed during the months of May to July, and it is stated that less than ten per cent. of the normal quantity of pyrites was imported during the first six months of the year. During the past few months there has been a revival in demand, in spite of German competition, but the future is uncertain owing to the Spanish Government's proposal to tax pyrites exports. Trade in alkalies and bleaching powder revived in July after the coal stoppage, and a fair trade is being done. Calcium chloride has been in demand throughout the year, the shortage of supply accounting for the maintenance of the market. It is interesting in this connection to record the passing out of use of the Leblanc process for the manufacture of alkali, for which two methods of production have now been substituted, the first being an electrical process for the manufacture of bleaching powder and caustic soda from salt, and the other the ammonia-soda process for the production of carbonate of soda, both of which are more economical.

The outstanding feature of the market for coal-tar distillation products during the year has been the steady demand for benzol and toluol, chiefly for use as motor fuel. The prices of pure benzol and toluol have been maintained at an even level of from three shillings to three shillings and sixpence per gallon, and the demand has usually been in excess of supplies. Other products such as creosote, solvent naphtha and pitch have maintained fairly constant prices, but shortage of supplies of raw materials prevented manufacturers from committing themselves too extensively. Carbolic and cresylic acids, refined heavy naphtha, naphthalene and pyridine have been consistently dull markets nearly all the year, but manufacturers are looking forward to better markets in 1922. Foreign competition has gravely affected the export trade in wood distillation products, and the industry is passing through a very critical period.

The Dyestuff Industry.

The British dyestuff industry began 1921 under the heavy handicap of an overstock in the country of German dyes, and the unprecedented slump in the textile industry, especially in the spring of the year, was productive of extreme slackness in the manufacture of dyeing materials, a large proportion of the plant having to be closed down. The conclusion of the coal stoppage proved to be the beginning of an improved tendency in the coal-tar dye industry which has fortunately been maintained, and the prospects of a revival are now much better than they have been at any time during the past twelve months. Hopes are being expressed that—failing any further untoward circumstances—the industry will see quite an appreciable amount of business in both intermediates and general raw materials for dye-making. Orders for aniline dyes have been much freer and for rather larger quantities, though prices have remained practically stationary. The outstanding items of interest in the British dyestuffs industry during the year have been the reorganization in the staff of the British Dyestuffs Corporation, Limited, and the partial protection of the industry against German competition under the Safeguarding of Industries Act. The appointment of the Dyestuffs Developments Committee is of importance to the future of the industry, and there has been considerable progress in research. The list of dyestuffs being manufactured in Great Britain has attained considerable proportions and the eighteen British dye makers collectively now provide a large range of colours. Considerable controversy is still being carried on regarding the dyestuffs which shall be permitted to enter the country from foreign sources, and dye users continue to complain of the range and lack of uniformity of British products. While progress has been made, the extension of the number of dye products made by British firms is a matter still requiring a considerable period of time before an approach can be made to the number of colors offered from Continental sources of supply. The Dyestuffs Developement Committee is ascertaining exactly what dyes are being made or can be made in Great Britain, and is also giving attention to the question of standardizing the products turned out and eliminating irregularities. It has, however, to bear in mind that in working for the benefit of the color-making industry the color-using industries must not be placed in a disadvantageous position in their competition with products made in countries having access to German and American dyestuffs. So far as research is concerned, many of the cleverest chemists of the United Kingdom, under the leadership of Drs. Green and Robinson, are continually engaged in attacking both the technological problem of producing dyestuffs on more economical lines and the pure chemical problems upon which depend the evolution of new coloring bodies. Important discoveries resulting in new processes for the manufacture of certain intermediate products in purer form and at reduced cost have been made during the year. The export trade in dyestuffs is in a state of chaos owing to German competition and the protection of overseas dyestuffs industries, particularly in the United States, but in that country British dyes find quite a good sale where no domestic competition is met.

Fine Chemical Market.

The market for fine chemicals has been steadier and the demand more consistent than has been the case in other branches of the industry. Up to the passing of the Safeguarding of Industries Act prices had a falling tendency, much Continental stock being offered in Great Britain. When it became apparent that the Government intended to go through with this measure, supplies of fine chemicals were rushed into the country, especially from Germany, and much price-cutting was indulged in for a short time. Fine chemicals of German origin, admittedly inferior in quality to British products, are being sold, and the stocks on the market are expected to prevent values increasing to the full extent of the new duty of 33⅓%, particularly in view of the uncertainty created by the continued depreciation of the German mark. The operation of the Safeguarding of Industries Act has created grave discontent even among its original sponsors and there is some reason to believe that its repeal is under consideration by the Government. Whether repeal or drastic amendment will actually ensue, however, cannot at present be foreseen, but it is of interest to note that an important meeting of representatives of all chemical interests have asked for a joint committee to consider revisions.

Iron and Steel.

While trade is distinctly on the up-grade, there is a great distance to climb before the pinnacle of booming conditions can be said to have been approached. During the first eight months of 1921, the United Kingdom actually imported more iron and steel and manufacturers thereof than she exported—actually 1,105,000 tons of imports as against 1,025,000 tons of exports. Imports, however, have lately been easing off, though considerable quantities of raw and semi-raw material are being imported by steel manufacturers in view of the shortage of British pig iron occasioned by the coal stoppage. The importation of finished steel goods is, however, responding by decreased figures to the increased output of British plants.

France.

The outlook in the French chemical industries is decidedly brighter. At present it is greatly inconvenienced by high transport charges. Nevertheless, a brisker tone prevails. In the works of St. Fond, near Lyons, output for the majority of products has assumed the same proportion as in 1913.

The chemical as well as other industries are keenly watching the conclusion of commercial agreements with foreign powers, and are anxious that any new arrangements should give them the same protection as they enjoyed before the war.

Following the import of much German potash the Government raised the tariff to 30 francs per 100 kilos to protect French mines.

Italy.

The Italian metallurgical industry is again passing through a very grave crisis. Strikes have occurred in Liguria district. The banks will not agree to carry the Ansaldo Company and the "Ilva" plants have not been supported by their French backers.

Germany.

Germany has made considerable progress since the conclusion of the Armistice in the economic utilization of coal and lignite, and it is claimed for Friedrich Bergius, one inventor, that he can take practically any kind of coal, and by means of temperature, pressure and the addition of hydrogen, obtain in the final result motor fuel, lubricating oils, lamp oil, paraffin wax and other valuable products. This is accomplished, in particular by the application of pressures truly enormous for an industrial plant, ranging from 100 to 200 atmospheres. A large-scale plant has been erected at Rheinau, and is stated to have worked successfully, though it seems still doubtful whether commercial operation will be practicable. The process is said to be suitable for crude petroleum as well as for the liquid products obtained from coal, and this partly explains why an agreement has been made between the proprietors of the Bergin process and the Royal Dutch and Shell oil group to promote the development and exploitation of the process outside Germany.

Bergius has a rival in Dr. H. Magnus, of Freiburg, Baden, whose process is claimed to be simpler; he uses low temperatures and ordinary pressure. The raw materials to be treated, whether derived from coal or from petroleum, are intimately mixed with hydrogen and led through an arrangement of columns, when catalysis takes place—i. e., the products become more fully charged with hydrogen, and thus become more volatile. A Czecho-Slovak chemist, Dr. L. Steinschneider, is responsible for another process starting from the coal tar got by ordinary methods of distillation. But it is believed on good authority that at his works at Koenigsfeld, in Czecho-Slovakia, he is operating a new plant which will treat the coal right through. In other words, he first slowly distils the coal, causing it to give a very large proportion of liquid, and then he treats this liquid so as to obtain from it a considerable percentage of light products, including motor fuel. It is, indeed, surprising what can be got out of coal by skilful laboratory methods; but the trouble has so far been to utilize these methods in large scale plants. Steinschneider does it with a very simple arrangement called a retort still, which avoids high temperatures and smelly products, and utilizes practically all the available liquid products of the coal. Like the other two processes mentioned, this one also can be applied to petroleum. In view of the rivalry of oil as a fuel, exemplified in the United Kingdom during the coal stoppage, the coal industry is seeking for some cheap method of converting the raw material into a number of well-defined and commercially-valuable products, including liquid, gaseous and smokeless solid fuel, one company, the Low Temperature Distillation Company, having recently proclaimed important results from experiments carried on at its Bradford plant.

German Fertilizer Prices.

The German Government has sanctioned a further price increase for nitrates, amounting to 20 per cent. for cyanamide, ammonia, and ammon-saltpetre fertilizers, and 37 per cent. for pure sodium nitrate, as from October 10.

There is close competition between Alsatian and German potash producers.

German Potash Industry.

German potash wealth left after the war centres in and around the Harz Mountains. It is remarkable for the ease with which it can be mined, 86 per cent. occurring within a depth of 1,200 metres, while another 10 per cent. lies within a depth of 1,200 to 1,500 metres. The Potash Syndicate states that last year the total production of potash salts in Germany amounted to 11,386,439 metric tons. Compared with 1919, when 7,772,036 metric tons were produced, the 1920 output showed an increase of more than 3,000,000 metric tons, as well as a most favorable comparison with production in pre-war years, the output in 1911 amounting to 9,706,507 tons and in 1913 to 11,607,510 metric tons. German sales of potash salts in 1920 amounted to 4,313,325 tons, as against 4,155,104 tons in 1919, and 5,187,298 tons in 1913. The difference between the figures of sales and those of production is due to the loss of weight which some potash salts undergo in the process of working up. Since 1914 the sale of potash salts has been limited largely to domestic markets. According to a recent report by the American Assistant Trade Commissioner at Berlin, the summer season of 1921 found the German potash monopoly beset by a business stagnation so aggravated by lack of both foreign and domestic orders, that some plants are being forced to close down. Sales during the period of January to May of this year were 150,000 metric tons short of those for the corresponding period in 1920. The chief factors generally viewed as contributing to the situation were (1) lack of orders from Germany's one-time best customer, the United States; (2) loss of the potash deposits of Alsace and resulting competition in foreign markets; (3) continued pohibition of export to Poland, and through Poland to the East, and (4) curtailment of domestic consumption.

The Oppau Explosion.

The Badische Aniline and Soda Company reports that the explosion at Oppau will not in any way influence the manufacture and export of dyestuffs and other chemicals.

The causes of the catastrophe are as yet obscure. At first, a small explosion took place, which cannot be accounted for at all. This was followed by the explosion of 4,000 tons of ammonium sulphate compound. No one has as yet fathomed how this came about, as repeated scientific experiments have proved that this artificial manure cannot explode. In fact, hardened lumps of this compound were often blasted in order to pulverize them, an operation which never entailed suspicious developments. Even now the commission of experts attached to the Ministry of Agriculture, does not consider it necessary to restrict the use of ammonium saltpetre in agriculture or in industry; rather does it advise agriculture to make an intensive use of it.

In view of the large supplies of nitrate which will require to be sold, it is not considered that the explosion at Oppau will make much difference to the market for fertilizers in the spring. It was understood to be doubtful, even before the explosion occurred, whether Germany would have sufficient supplies for export during that period. It is now understood that the ammonia plant at Oppau is likely to be working again within a few months, and that steps have already been taken to make up the loss of nitrogen by bringing into operation one of the spare units at Merseburg.

Agreement on Nitrate Prices.

The Chilean nitrate producers and the British wholesale dealers in nitrate have come to an agreement regarding a scale of prices for nitrate with a starting price of 10s. 6d. per quintal.

French Electro-Chemical Plants.

It is understood that the French controlled electrochemical factory of Martigny, which was closed two years ago, is to be reopened. This factory produces nitrate of phosphorus for industrial and agricultural purposes. Other electro-chemical factories in Switzerland have been practically at a standstill but are now also making preparations for renewed activity. It is not clear whether the awakening demand upon the cyanide and sulphate of ammonia works is due to the destruction of the stocks of the German aniline factory at Oppau. The inquiries are not coming from Germany, but chiefly from France. The recovery in the electro-chemical trade has not yet affected the calcium carbide factories.

The Electrolytic Zinc Industry of Tasmania.

At the beginning of August the baseplate of the first rotary converter in the power house of the Electrolytic Zinc Company, at Risdon, near Hobart, Tasmania, was laid. This is a war industry inaugurated to assist in the production of high-grade zinc and sulphur from Australian raw materials. It is anticipated that by the end of the year production would be on foot, utilizing at least 15,000 H.P. from the State hydro-electric works. The new cellroom is practically ready for the utilization of the full 30,000 H.P. covered by the contract with the Government. When the plant is in full operation it is estimated that the value of the annual output will amount to £2,200,000.

Carbide Industry Assisted by Government.

The Hydro-Electric and Metallurgical Company's carbide factory at Electrona, Tasmania, which has been in difficulties owing to lack of capital, has been assisted by the State Government to the extent of an additional £30,000, and this new Tasmanian industry has thus been saved from extinction.

Australian Copper and Osmiridium.

The annual report of the Tasmanian Mines Department states that the Mount Lyell mines, which are amongst the largest producers of copper in the Commonwealth of Australia, produced during the past year 4,791 tons of copper of the value of £528,237. The dividend paid was £64,459, equal to 1s. per share. Since the inception of the company it has produced 168,374 tons of copper (fine), and 371,686 ounces gold (fine), and paid in dividends to end of 1920 an aggregate of £3,830,009. The output of ore is now 9,500 tons per month, production being almost back to pre-war level.

The output of osmiridium in Tasmania during the past year was 2,009 ounces, valued at £77,144, being nearly the double of last year's output. The price ranged from £30 to £42 per ounce. Since 1910 Tasmania has produced osmiridium of the total value of £200,191 of the average value of £20 per ounce.

Japan Increasing Imports.

After a long continued suspension of imports of chemicals into Japan, owing to high quotations, in overseas countries, the demand for foreign chemicals is increasing.

A Chinese Industry.

Vegetable tallow is an important commodity in the export trade of China, and in normal times the annual shipments totalled from 200,000 to 300,000 piculs. Before the war, most of this was sent to the Netherlands, France and Germany, but since 1914 the United States, Italy and Great Britain have become the chief buyers. From figures published by the Chinese Maritime Customs it appears that during the last few years there has been a marked fluctuation in the quantity of tallow exported. In 1916 no less than 256,960 piculs were sent abroad, but in the following year this had decreased to 151,385 piculs, and a slight improvement of 11,000 and 13,000 piculs in 1918 and 1919 respectively was in turn followed by a heavy drop to 69,118 piculs for last year. The home consumption of tallow in China is about equal to the foreign demand. The principal port of export is Hankow, which controls 90 per cent. of the trade, other ports being Kiukiang, Ichang, and Chungking. The producing districts are in the northwestern part of Suifoo, Szechwan, in the *hsiens* on the borders of Hupeh, Szechwan, and Kweichow, and the northwestern section of Hweichow, Anhwei. In China, the tallow is for the most part used in the manufacture of candles, but in Europe and America it is used to manufacture stearine for soap. There are three kinds of vegetable tallow, viz., skin tallow, which is obtained from the fat adhering to the seeds; seed tallow, which is obtained from the kernels of the seeds; wood tallow, which is a mixture of skin and seed tallow. The so-called "Chinese Vegetable Tallow" contains from 10 to 20 per cent. of wood tallow, and is, therefore, a mixture.

Spain.

The Spanish Government has established a Commission of technical experts for the purpose of investigating the question of the amount of protection necessary for the development of chemical industries in Spain.

Australia.

The Board of Trade in London announce that they have instructed their agents in Australia to ship a supply of Broken Hill zinc concentrates to England, and will be prepared, if desired, to maintain supplies to meet the immediate requirements of smelters in the United Kingdom.

Chilean Nitrate Industry.

The British Consul at Antofagasta reports that the production of nitrate during the first six months of the current year amounted to 18,544,943 quintals, making a total production for the nitrate fiscal year ended June 30th of 47,263,030 quintals, compared with a total production in the previous year of 42,549,379 quintals. Exports of nitrate during the past fiscal year amounted to 44,576,839 quintals, as against 47,974,649 quintals in the previous year. Stocks of nitrate at June 30th were approximately 55,000,000 quintals, and the output for the month of June was 2,080,000 quintals. A normal year's consumption before the war was generally estimated at from 40 million to 50 million quintals.

Of 142 nitrate factories 93 had closed down on June 30th, and it is difficult to understand the reason so many continue working, though they are doing so at a very reduced capacity. The severest sufferer from the critical situation is the Government, which is dependent, to the extent of 70 per cent. of the total revenue of the country, on nitrate duties, and, in the second instance, the unemployed, most of whom have again been sent to the South.

NEW NEWSPRINT MILL HAS LARGE CAPACITY.

The new newsprint mill of the International Paper Co. at Three Rivers, Que., which is expected to commence operations early in February, will have an initial capacity of 100 tons per day, which will be increased later to 200 tons.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy.)

INCREASING SILVER, LEAD AND ZINC OUTPUT.

The lessees of the Ottawa Mine, in the Slocan, have shipped 26 tons of concentrate to the Trail smelter. L. H. Biggar, one of the lessees and manager of the mine, states that this concentrate was obtained from some 900 tons of ore, averaging 12 ounces of silver per ton, taken from the old dumps, and that it contains about 75 per cent of the original silver content of the ore. The cost of handling, concentrating, and freighting to the smelter—a distance of 80 miles—was about $2 per ton of ore, leaving a profit in the neighborhood of $7 per ton. While at first blush 75 per cent. may seem to be a low extraction, it should be remembered that the ore is what is locally known as a "dry" silver ore, that is, it contains practically no base metals, and has been on the waste dumps, exposed to the oxidizing effects of the weather, for several years. It is proposed, however, to double the capacity of the plant and to treat custom ore. Such a plant has long been wanted in the Slocan, as in the mining of shipping ore there generally is a considerable amount of second-grade ore produced, which is not rich enough to bear freight and smelting charges. If such ore can be handled at a concentrating plant on the spot a great saving should result to the mine operators. The mine owners throughout the Province have been slow to realize the value of concentration. The Slocan mines are showing greater activity, now that the Consolidated M. & S. Co. is in the market for silver-lead ore once again than at any time during the present year. O. C. Thompson and W. B. Horton, who recently bonded the Utica mine, have struck two new oreshoots in the bottom workings; one shoot is 18 and the other 24 inches wide, and both shoots are composed of clean shipping ore.

The Dolly Varden mine, in the Alice Arm district, has been closed indefinitely. The damage to the railway is a matter of serious concern to all the mines and prospects in the Upper Kitsault Valley.

North Star Mine Reopened.

The North Star mine, at Kimberley, which has been idle since the beginning of the year, has been reopened, and, it is understood, will continue to ship to Trail so long as satisfactory terms can be obtained for its products. Last year this mine shipped some 6,500 tons of ore to the Trail smelter. The Federal Mining and Smelting Co., which recently bonded the Stemwinder and Ontario groups, at Kimberley, has let a contract for exploratory diamond-drilling to Lynch Bros., of Seattle and Vancouver. The Consolidated M. and S. Co., which for a time curtailed the output of its Sullivan mine, at Kimberley, is shipping large quantities of ore from that mine again. It is understood that the Consolidated Company has made large lead and spelter sales recently, and that the stock of lead on hand now is only sufficient for normal trade purposes, while the stock of spelter has been greatly reduced. Hence the increased output of the Sullivan mine. The ore receipts at the smelter for the first week in November were the largest for any single week during the year.

New B. C. Mining Association.

The representatives of most of the metalliferous mine owners in the Kootenay district met at Nelson recently and organized the Mining Association of Eastern British Columbia, for the purpose of guarding the metalliferous mining interests in that part of the Province. The following provisional officers were elected:—R. R. Bruce, president; Clarence Cunningham, vice-president; W. H. Burgess, secretary-treasurer, and T. W. Bingay, G. S. Blaylock, W. A. Davis, S. S. Fowler, Douglas Lay, J. A. Madden and W. T. McDowell, executive. R. R. Bruce and J. J. Warren were appointed a committee to go to Victoria to interview the Provincial Government for the purpose of obtaining relief from the present heavy burden of taxation under which the industry is staggering.

Britannia Mine Continues Operations.

The outstanding recent event was the disaster which befell the mining settlement of Britannia Beach on October 28th. A wall of water and debris destroyed fifty houses, with a loss of about forty lives. The mine is continuing operation.

Platinum Discovery.

At Franklin Camp, in the Grank Fork mining division, on a belt of pyroxinite, a ten-foot body of ore, assaying 4.3 per cent. copper and 0.11 ounces of platinum per ton, has been opened up. This body was examined during the war and later, but nothing so promising was found at that time.

Recent Gold Discoveries.

Placer gold has been discovered at Cedar Creek, Quesnel Lake, in the Cariboo district.

A rich bed of iron oxide, carrying much gold, has been opened up by A. Saunders, near Baskerville, B.C. Some samples run up to $450 a ton.

The Nugget Gold Mines, Ltd., of Sheep Creek, near Nelson, are again operating, and have produced about $60,000 this season. The mine is well equipped with small ten stamp mill, pebble mill and cyanide plant.

The Reno Gold Mines, Ltd., has been organized, at Nelson, to take over properties at Sheep Creek.

A sensational strike was made at the I.X.L. mine, at Rossland. The Trail Smelter reported 183.6 ounces to the ton, on a vein about 6 to 10 inches wide.

Coal Operations.

Several coal seams, formerly staked for Lord Rhonda, have been restaked at Terrace by the Callahan interests.

NORTHERN ONTARIO MINING DEVELOPMENTS.

During the four weeks ending November 14th, the Hollinger Consolidated Company's mill treated an average of 3,380 tons of ore daily. This constitutes a record for the mill and marks about the maximum that may be expected with the present milling equipment. Further increases will take place when extra ball mills are installed.

That too high prices are asked for mining claims in Northern Ontario, thus hindering development work, is the opinion of Mr. James J. Godfrey, well-known mining man of New York, who recently visited the Porcupine and Kirkland Lake fields in Ontario. Mr. Godfrey believes that the Northern Ontario field will develop into a second Rand and he estimates the gold mining belt alone as 80 miles long by 30 miles wide, of which only the fringe has been touched up to the present time.

An important strike has been made on the Davidson Gold Mine at Porcupine by the discovery of a big ore shoot at the 600 foot level. Sir Arthur Mitchelson of London, has provided $1,000,000 for the development of the Davidson.

Colonel Macklim, Engineer Jenks, and James Godfrey, said to represent the Thomas W. Lawson interests of Boston have recently made a survey of the Kirkland Lake District, and it is rumored that as a result securities representing the best mines of Northern Ontario will be marketed actively in New York and Boston.

The Mining Corporation of Canada, whose mine is in the Cobalt area have taken an option on the Haileybury-Frontier property in South Lorrain. The Frontier mine is a very promising deposit and has already been developed at the 150 and 300 foot levels and if successful development continues it will not be long before the Frontier will require a mill.

Another gold producer was added to Ontario's resources on Nov. 28, when the Ontario-Kirkland commenced hoisting ore into their mill. The Ontario-Kirkland is the fifth mine to be developed to the actual production stage in the Kirkland Lake district. The Porcupine district has three gold producers at present. Development work on the Ontario-Kirkland has proven the existence of a second pay ore zone, when it was previously thought that only one zone ran through the camp. Further exploration work in the district has resulted in the location of three ore zones, and evidence of others have been secured. The Ontario-Kirkland's mill has a capacity of 100 tons per day, while the ore will average in gold, around $15 per ton. A monthly output of between $40,000 and $50,000 is indicated. The deepest workings are at the 450 foot level, while most of the ore has been met with at the 300 and 450 foot levels.

Fifteen years ago the first important gold discoveries were made in the Temiskaming section of Northern Ontario at Larder Lake. There followed a boom that wasted a great deal of money, blasting many hopes. While the Porcupine and Kirkland districts were being discovered and developed the Larder Lake camp remained dormant for ten years. "The Northern Miner" (Cobalt) in a recent issue states that to-day there are good hopes of a revival at Larder Lake and that it appears as one of the best of the non-producing camps, thanks to the activites of the Associated Goldfields, Ltd., the Coniagas Mines, Ltd., and the various Crown Reserve Company's interests, who are all there working on the vein discovered at Larder 15 years ago. The engineers in charge of operations believe that the vein extends through several claims at a width of from 15 to 60 feet, of which they suppose a large part will be ore, and if it is, the proposition will turn out to be a very good thing.

UTILIZATION OF COTTON STALKS.

An article in the Bulletin of the Imperial Institute deals with the problem of the commercial utilization in cotton-growing countries of the vast quantities of cotton stalks which are produced each year and have to be removed from the fields after the cotton crop has been gathered. Investigation at the Institute has shown that the stalks form a promising material for paper-making, and that they might also be used for obtaining acetic acid, tar and charcoal by a process of dry distillation.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported specially for "Canadian Chemistry and Metallurgy" by A. E. MacRae, Ottawa.

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Method of Evaporating Waste Sulphite Cellulose Lye.

H. A. E. Nilsson, 214450, November 29, 1921. Sulphite lye is heated to 90-100° and the incrustation forming constituents of the lye are precipitated with $Ca(OH)_2$ or pulverized limestone and removed. The lye is then passed through heating elements, the exterior surfaces of which are exposed to the heating action of compressed vapors from the lye.

Production of White Gold.

D. Belais, 214412, November 29, 1921. An alloy used as a substitute for Pt contains Au 75-85%, Ni 10-18%, Zn 2-9%, and Mn ½-2%.

Apparatus for Treating Ores or the Like.

G. H. Clevenger, 214562, December 6, 1921. A furnace for treating ores under precisely regulated conditions has an extended reaction zone, means for passing a combustible gas through the zone and means for variably admitting air at intervals along the reaction zone.

Production of Soda Containing Water of Crystallization.

Dr. A. Welter, 214277, November 15, 1921. $Na_2CO_3 10H_2O$ is produced by spraying fine particles of water upon pulverized calcined soda and preventing liquefaction or coking by keeping the soda in motion. Hydrous solutions of soap, Glauber's salt or water-glass may be used for spraying to give desired mixtures.

Process for the Magnetic Separation of Ores.

C. Thom, 214473, Nov. 29, 1921. The ore is heated without roasting to 800-1200° F., which temperature causes the ore when cooled to yield the maximum magetic susceptibility, then cooling the ore under such conditions of heat exchange and time limitations ranging from 5-15 minutes as to retain this susceptibility.

Acetic Aldehyde From Acetylene.

A. Guyot, 214472. The acid solution containing a Hg salt through which C_2H_2 is passed is continuously subjected to the action of a vacuum to resolve the CH_3CHO as it is formed.

Process for the Manufacture of Ethyl Alcohol From Acetaldehyde.

T. Lichtenhahn, 214185, November 8, 1921. In the reduction of CH_3CHO with an excess of H in the presence of a catalyst up to O, 3% of O is added to the gaseous mixture and the temperature maintained at 90°-170°.

Solder.

J. G. Kelly, 214193, November 8, 1921. A solder contains 34% Pb, 34% Sn, 30%Zn, and 2% Al.

Catalyzers.

W. W. Scott, 214290, November 5, 1921. A catalyzer for producing oxides of N contains an oxide of Co and an oxide of Al.

Process for Producing Finely Granulated Compounds.

Dr. A. Welter, 214278, November 15, 1921. Finely granulated compounds are producted by spraying fine particles of liquid on fine particles of a solid substance under agitation. A liquid may be used which will coat each granule. Particles of $NaBO_3$ coated with water-glass may thus be prepared. Fine hydrous crystals of Glauber's salt may thus be prepared from the anhydrous salt by using a spray of water.

Acetic Acid by the Oxidation of Ethyl Aldehyde.

A. Guyot, 214163, November 8, 1921. Vapours of CH_3CHO are oxidized by a gas rich in O in the absence of a catalyzer. The resulting product is caused to flow continuously from the oxidation towers to a heating apparatus where any CH_3CO_3H formed during oxidation is decomposed. Any dangerous accumulation of ferocetic acid is thus avoided.

Continuous Process for the Preparation of Monochlor-acetic Acid Starting From Trichlorethylene.

A. Guyot, 214164, November 8, 1921. Cb_6Cl_3 is passed into H_2SO_4 at about 160°. The concentration of the acid is maintained at about 90% by the addition of water. The $CH_2ClCOOH$ is removed as formed by causing an excess of $CHOCl_3$ to bubble through the acid.

Recovery of Zinc by Electrolysis.

R. H. Stevens, 214166, November 8, 1921. A protective coating of Zn is provided on the surface of the cathode above the solution level to eliminate the corroding action of the acid spray.

Separating Nickel From Cupro Nickel Alloys, Scrap, Etc.

A. McKechnie, 213948, October 25, 1921.

Production of Ammonium Chloride.

O. L. Christenson and K. I. M. Gisiko, 213992, October 25, 1921. A mixture of a N containing organic substance, alkali chloride and free SiO_2 is heated to distill off NH_4Cl.

Non Flammable Volatile Liquid.

A. Hemming, 213825, October 18, 1921. A non-inflammable volatile liquid, consists of a mixture of methyl chloride and methyl bromide.

Production of Sulphuric Acid.

K. B. Quinan, 213850, October 18, 1921. In the production of H_2SO_4 a layer of the acid is maintained above a permeable diaphragm and the oxides of S and N are passed upwardly through the diaphragm and acid in sufficient volume to prevent excessive percolation of the acid.

Filaments Formed of a Single Crystal.

O. Schaller, 214061, November 1, 1921. The metallic filament consists of a single crystal throughout its whole length and cross section.

Recovery of Organic Products From Wood.

H. F. Weiss, 214080, November 1, 1921. Wood which may first be steamed, is subjected to a grinding operation with circulation of water to carry away the wood pulp. The water is separated from the pulp and re-circulated during further grinding operations to increase the concentration or organic products therein. The volatile organic products are then extracted from the liquor by distillation. The process is particularly applicable to the wood of the western larch which contains galactan. The galactan may be converted into galactose and fermented to produce alcohol.

Treatment of Wood and Recovery of Organic Products Therefrom.

H. F. Weiss, 214081, November 1, 1921. The wood of the western larch is finely comminuted and leached with an aq. solution to remove the galactan and other soluble constituents. The extracted wood in a moistened, heated condition, is then subjected to a sulphite or other pulp digestion process to produce pulp and a waste liquor containing the remainder of the soluble constituents of the wood. The preliminary removal of the soluble constituents promotes the pulp making process and reduces the amount of chemicals required.

Steel Production.

A. E. Smaill, 214542, December 6, 1921. Steel is refined, toughened and strengthened by adding to the molten steel an oxide content of Na and iron, Ni or other desired metals may be added to the Na_2O. A .40 C steel so treated has an upper critical temp. of 1650° F.

An Alloy for the Purification of Steel.

A. E. Smaill, 214541, December 6, 1921. An alloy containing Na_2O associated with a metal or metals for refining steel is produced by forming a matte, which disintegrates on exposure to a moist atmosphere, by heating a sulphide ore, such as Fe-Ni, with NaOH, cooling, separating the slag, exposing the matte to a moist atmosphere and roasting the powder. The alloy should contain less than .5% S and about 2% Na.

Method of Recovering Precious Metals From Solutions.

R. H. McKee, 214525, December 6, 1921. C which has been subjected to treatment with an alkaline solution at a red heat and afterwards leached, is used as a precipitant for Au and Ag. The leached block ash residues from soda pulp manufacture may be used.

WESTERN OIL DEVELOPMENTS.

Officials of the Union Oil Company of California have been in Vancouver for a week, looking over all available water-front property. They have bonded the British Columbia Refineries property, near Barnet, and purchased the old Kirkpatrick mill, which formerly was used for the manufacture of shingles. The Refineries property has excellent wharfage, capable of accommodating the largest oil-tankers. The property is valued at $400,000.

For some time past the Union Oil Company has been bringing crude oil to Vancouver; now it proposes to enter the refining business, which previously was entirely in the hands of the Imperial Oil Company.

With coal at $12 to $13 per ton, the average retail price in Vancouver and Victoria, fuel-oil is found to be a cheaper form of fuel, both for industrial and domestic heating, and evidently the Union Oil Company appreciate this fact, for, it is understood, that the company is prepared to invest four million dollars in property and plant. Naturally the colliery owners lament the invasion, and are endeavoring to get a higher duty placed on oil, in order to protect the coal industry. Such an increase of duty, however, would be bitterly opposed by all industrial concerns, the owners of which consider that already they are paying too long a price for their fuel. The only effective way by which the colliery owners can combat the invasion of fuel-oil in their territory is by cheapening the price of coal. Fuel users, the large majority of whom are within a hundred miles from the collieries, feel that they have been "held up" long enough.

BRITISH COLUMBIA INDUSTRIAL NEWS.

The plant of the Calcium Carbonate Company, at Merritt, which has been held up for some time because part of the machinery had not been delivered, was put into operation on October 15, and is said to be turning out a satisfactory grade of "whiting," which will be used in the manufacture of paints, kalsomine, scouring soaps, metal polishes and rubber tires. The company has a contract in the Orient that will take most of its output for some time. There is said to be ample mineral in the deposit to keep the plant in operation for many years, and it is proposed to double the capacity of the plant in the spring, in order to supply the Canadian trade.

Arrangements have been practically completed for the organization of the Union Oil Company of Canada, which will be a subsidiary company of the Union Oil Company of

California. The company has the British Columbia Refineries, Ltd., plant, near Barnet, on Burrard Inlet, under bond, and has purchased properties at Victoria and at New Westminster, on which storage plants will be built. It is understood that about $1,500,000 is to be spent at once in the purchase of lands and the erection of equipment.

The Granite Island Quarries, Ltd., which owns and operate quarries on Granite Island, Jervis Inlet, recently shipped a large consignment of granite to Australia.

It is reported that the $6,000,000 pulp and paper mills at Fort George, which have been under consideration for some time, are to be commenced at once, if the negotiations with the Provincial Government for timber limits, now pending, are successful.

Alberta.

R. W. Campbell and C. B. Hammond, Texas oil operators, are reported to have purchased 1,900 acres of bituminous-sand lands, two and a half miles from Fort McMurray, from an Edmonton syndicate. The new owners claim to have devised a process for extracting the bitumen from the sand, much of which contains 15 per cent. of bitumen.

REPORT ON CANADIAN MANUFACTURES

The Dominion Bureau of Statistics, Ottawa, has completed a preliminary report on the manufacturing industries of Canada for the year 1919. In the section of the report dealing with the forty leading industries of the Dominion much interesting data is given. The following are a few of the industries listed, together with capital invested, cost of materials used, and the value of products made:—

Industry	No. of Plants	Capital Invested	Cost of Materials	Value of Products
Pulp and Paper..	99	$275,767,364	$53,681,786	$139,986,457
Sugar, Refined...	8	38,725,542	86,308,204	102,630,086
Rolling Mills and Steel Furnaces.	41	88,106,635	43,950,662	89,229,144
Packing House..	82	93,363,791	175,133,821	233,936,913
Automobile	41	31,949,739	51,690,715	80,619,846
Foundry and Machine Shop Products	731	100,606,542	26,301,761	81,710,215
Rubber	32	42,787,594	27,534,414	56,003,434
Leather	113	34,623,567	34,927,878	46,925,933
Petroleum	10	43,158,655	26,264,839	43,256,317
Smelting	14	66,038,681	....	51,626,816
Boilers and Engines	64	31,277,375	9,789,399	24,708,143
Electric Light and Power	805	416,512,010	....	57,486,458
Electrical Apparatus and Machinery	95	45,956,399	15,257,617	34,187,658

The chemical industry does not appear in the list but, according to "The Canada Year Book, 1920," chemicals and allied products for the year 1918 number 337 plants; capital invested, $134,377,823; cost of materials, $93,754,000; and value of products, $173,649,073.

REPORTS RECEIVED.

The Preparation of Synthetic Organic Chemicals at Rochester Those who attended the annual meeting of the Society of Chemical Industry at Montreal last summer will remember the address of Dr. C. E. K. Mees of the Eastman Kodak Co., Rochester, N. Y., on "The Preparation of Synthetic Organic Chemicals at Rochester" as one of the best of the meeting. At the conclusion of his address Dr. Mees, in reply to a query, announced that the Eastman Company would publish reprints of his address with illustrations. These reprints are now available and form a decided contribution to the subject of the preparation of synthetic organic chemicals. The chemists of both the United States and Canada owe a debt of gratitude to Dr. Mees and his staff for the work they accomplished in providing special chemicals at a time when they were urgently needed by laboratories, the supply of German products having been shut off by war. A description of this very valuable work is given in this booklet, copies of which may be had from the Eastman Company.

The Canada Year Book, 1920.—This well known annual published by the Dominion Bureau of Statistics has again appeared, this latest issue covering the year 1920. The leading article is on Reconstruction. It is divided into three parts, the first dealing with internal war-time activities of the Government and people, the second with the re-establishment of the returned soldier, and the third with reconstruction among the general population. The book contains a great deal of very valuable information concerning trade and commerce in general and of particular industries. Education, Labor, and Agriculture are excellently dealt with also, and the work is a standard reference that reflects great credit on the compilers.

CATALOGS RECEIVED.

McKay School Equipment Co. Catalog—Scientific and Educational Equipment.

This catalog, "Science and Education," which is one of the first of this kind from a Canadian house, covers the ordinary needs of practically every type of laboratory in the country, including the industrial laboratories. A number of reference and comparison tables at the beginning of the volume make a useful ready reference. The catalog proper is divided into sections so that each section may be issued separately if necessary, such as Bacteriology, Analysis Apparatus, General Chemistry, Agricultural and allied subjects, Physical Apparatus, Projection Apparatus, Assay and Mining, Chemicals, Stains and Reagents. The numbering system is so designed as to take care not only of immediate needs, as manifested in the items actually listed, but leaves room for the probable and possible additions that may be made. The numbers themselves are arranged so far as possible so that very frequently called for items have an easily remembered number, for instance, 1050 commences beakers; 1500 commences combustion apparatus; 1800 commences filter papers; 1900 commences flasks; 2000 funnels, and so on. The index forms a cross reference. The chemical list is an extensive one.

The catalog is one of the best in the field covered that has appeared. From a typographical standpoint the workmanship is excellent. The illustrations are numerous and well arranged, while the type is easily read. Needless to say prices are given for every article mentioned.

A TRADEMARK OF QUALITY.

All products of quality bear the distinctive brand of the manufacturer, therefore the Canadian Industrial Alcohol Company, Limited, refiners of the highest qualities of alcohol possible to produce, wish to announce that they have registered the trade mark, "Maple Leaf," and hereafter all their shipping packages, such as barrels and drums, will bear their trade mark, which is the Company's name surrounded by a Maple Leaf, and the words "Maple Leaf Brand" will be stencilled on the package.

Any manufacturer who receives a drum or barrel of alcohol bearing the "Maple Leaf" trade mark and brand, can rest assured that he is receiving the very highest quality of alcohol procurable, depending on the grade which he buys.

Chemical, Oil and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

CHEMICALS.

Financial experts have given it as their opinion that business has "turned the corner" and that we are already on the way along the road toward better prices and better business. No one would wish to dispute the wisdom of Wall Street and undoubtedly "things are looking better,' but we submit that in no other field has this process of "turning the corner" in business been so long drawn out as it has in the chemical industry. In October things looked considerably brighter and general trading in chemicals had much the best month of the year. Then, during November, a reaction was experienced, and while no serious declines in values occurred, yet the volume of business done was decidedly poor. At the end of November more than one chemical broker and dealer was on the verge of closing shop; and then December opened with a fair revival in buying that proved a decided stimulus to the market. Towards the end of the month trading quieted down again and in the first week of the New Year was pretty dull. However, the second week opens with business considerably improved and while one fears to speak with authority after the ups and downs of the past four months, yet it would seem that if the chemical business hasn't turned the corner it is at least three-quarters of the way around.

General Chemicals—While there have been some declines registered in the general and heavy chemicals recently, yet there are good indications that the reduction in prices is gradually coming to an end. There is a strong tendency for many of the important industrial chemicals to hold firm, while a few have advanced. Among the advances noted during the first week of the new year were: Carbon Tetrachloride, an advance of 2c; caustic potash, 1½c; sodium sulphate, 10c. per cwt. in bags; Ferric chloride, 1c; Talc, all grades advanced $2 per ton; stearic acid, 1c per lb.; oxalic acid, 2c. per lb., and oleic acid, 4c. per lb.

Declines—Borax, crystals, 1c. per lb.; Boric acid, 2c. per lb.; Calcium chloride, fused, $2 per ton; Calcium chloride, flake, $4 per ton; Lime, hydrated, has declined $4 per ton since November 1st and is now quoted at $19.25 per ton in ton lots; magnesium carbonate 3c. per lb.; magnesium sulphate ½c. per lb., reductions also made in ton lots, see list following. The heavy acids, sulphuric, hydrochloric, and nitric are holding firm with trading considerably improved.

Fine Chemicals—The slaughtering of prices that operated in the fine chemical and pharmaceutical market all during the past year is coming to an end and the new year opens with several lines sharply advanced. Resublimed iodine has advanced ¼c. per lb; potassium iodide is up 5c. per lb.; hydrogen peroxide, 5c. per lb.; sodium benzoate, 5c. per lb.; sodium bromide, 5c. per lb.; asprn is up 15c. per lb. and is quoted at $1.00—$1.10 per lb.; camphor has also advanced, as has chloroform and salicylic acid.

OILS.

Fuel oil is a little easier in price, while motor gasoline has entered the new year unchanged. Coal oil has advanced 1c. per gal. Mid-continent crude has advanced 50c. per gal., and is quoted at $2.00 per gal. Pennsylvania crude after advancing early in December has declined again to $3.50 per gal.

METALS.

The metal industry is still quiet, though steel mills report an improvement over December 1st business, though no advances in quotations have occurred, indeed mild steel bars have declined as have the sheets. The expected revival in copper has not as yet occurred and though prices on both the electrolytic and casting are declined, it is thought that a change for the better will be made probably by February 1st. The metal industry goes hand in hand with construction, and as the building trade is confidently expected to pick up in anticipation of a spring revival in all forms of building operations, it is very improbable that any lower quotations on metals will occur.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump and ground	100 Lbs.	4.75— 5.25
Ammonium Bromide	Lb.	.. — .42
Aluminium Sulphate, bags	100 Lbs.	.. — 2.50
Aluminium Sulphate, iron free	Cwt.	.. — 4.50
Ammonia, Aqua 26	Lb.	.11— .12
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.30
Arsenic	Lb.	.. — .14
Barium Sulphate (Barytes)	Per Ton	30.00—35.00
Barium Chloride	Lb.	.04½— .06
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb.	.. — .26
Barium Sulphate, B.P.	Per Ton	100.00—110.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	100 Lbs.	.03¾—.04¼
Borax, crystals	Lb.	.. —.06¾
Boric Acid, powdered	Lb.	.. —.15½
Bromine (technical)	Lb.	.. — .38
Calcium Carbide, car lots, f.o.b. works	Ton	.. —100.00
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —105.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	.. —110.00
Calcium Chloride, fused	Per Ton	38.00—40.00
Calcium Chloride, flake	Ton	.. —44.00
Caustic Soda, ground, drum	Cwt.	6.50— 6.75
Caustic Soda, solid, drum	Cwt.	5.75— 6.00
Camphor Monobromate	Lb.	.. — 3.00
Carbon Bisulphide, in drums	100 Lb.	.. — .12
Carbon tetrachloride, drums	Lb.	.19— 20
Chalk, Precipitated	Lb.	04¼— .06
China Clay, imported	Per Ton	30.00—35.00
Cobalt Oxide, black	Lb.	.. — 2.20
Cobalt Oxide, grey	Lb.	.. — 2.45
Copperas (Iron Sulphate) crystals	Lb.	.02¼—.02½
Copperas (Iron Sulphate) sugar	Lb.	.02¼—.02½
Copper Sulphate (Blue Vitriol)	Lb.	.07½—.08½
Corosive Sublimate (Mercuric Chloride)	Lb.	.. — .95
Fluorspar, ground	Tons	—30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.14— .15
Ferric Chloride, solution	Lb.	.. — .12
Hydrofluoric Acid, 60%	Lb.	.. — .30
Hydrofluoric Acid, 30%	Lb.	.. — .14
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	1.00— 1.10
Iodine, crude	Lb.	.. — 4.20
Iodine, resublimed	Lb.	.. — 5.00
Iron Oxide (red)	Lb.	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.15— .17
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.. — .10
Lithium Carbonate	Lb.	. — 1.70
Lithopone	Lb.	05½— .06
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl.	Lb.	.10— .12
Magnesium Sulphate	Lb.	.03— .04
Mag. Sulphate, B.P., Medicinal...Single	Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Muriatic Acid, 18	100 Lb.	2.75— 3.00
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt.	Lb.	.. —.16½
Nickel Salt, double, in bbl. lots	Lb.	.. — .15
Nickel Salt, double, per cwt.	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lb.	.09—.09¼
Phosphoric Acid, 85%	Lb.	.43— .50
Phosphoric Acid, 50%	Lb.	.29— .31
Phosphorus, yellow	Lb.	.. — .44
Potash Prussiate yellow	Lb.	.28- .30

Potassium Bicarbonate	Lb.	.. — .18
Potassium, Bromide, crystals	Lb.	.20— .27
Potassium, Bromide, granular	Lb.	.20— .27
Potassium Bichromate	Lb.	.. — .25
Potassium Chloride	Lb.	.. — ..
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .08
Potassium Chlorate	Lb.	.. — .12
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .80
Potassium Hydroxide (caustic potash) small drums	Lb.	.15— .20
Potassium Hydroxide (caustic potash) large drums	Lb.	.08— .10
Potassium Iodide	Lb.	.. — 3.50
Potassium Nitrate, kegs	Lb.	.14— .16
Potassium Permanganate, bulk	Lb.	.65— .70
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. —10.00
Soda Ash, bags	Cwt.	2.90— 3.00
Sodium Acetate, ton lots or over	Lb.	.. — .06
Sodium Acetate, lesser amounts	Lb.	.. —.07½
Sodium Benzoate	Lb.	.70— .80
Sodium Bicarbonate, 100% pure	100 Lb.	3.00— 3.50
Sodium, Bichromate, bbls.	Lb.	.09— .11
Sodium Bisulphite, powder	Lb.	.. —.09½
Sodium Bisulphite, 35	Lb.	.05½— .06
Sodium Bromide (foreign)	Lb.	.30— .35
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. —.26½
Sodium Hyposulphite, kegs	100 Lb.	5.50— 6.00
Sodium Iodide	Lb.	.. — 4.00
Sodium Nitrate, refined	100 Lbs.	7.00— 7.50
Sodium Nitrate, crude, 95%	100 Lbs.	5.00— 5.75
Sodium Nitrite	Lb.	.12— .15
Sodium Peroxide, f.o.b. New York	Lb.	.38— .40
Sodium Silicate, according to density	100 Lbs.	3.00— 3.50
Sodium Sulphate (Glauber's Salts) crystals	Per Cwt. in Bags	.. — 2.00
	Per Cwt. in Car Lots	.. — 1.60
Sodium Sulphite	Lb.	. — .05
Sodium Prussiate, Yellow	Lb.	.16— .18
Sulphur, ground	100 Lb.	2.75— 3.25
Sulphur, roll	100 Lb.	4.50— 4.75
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars		.. —24.00
Talc, No. 1 grade	Ton	.. —32.00
Talc, No. 2 grade	Ton	.. —27.00
Talc, No. 3 grade	Ton	.. —20.00
Tin Chloride, crystals	Lb.	30 — .35
Tri-sodium Phosphate	Lb.	.08½— .09
Ultramarine, Blue	Lb.	.15— .35
White Precipitate (Mercuric-Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	. —35.00
Whiting (American)	Ton	.. —28.00
Whiting	Per Ton	35.00—40.00
Zinc Sulphate, com.	Lb.	.05¾—.06½
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.9½—.10½
Zinc Stearerate	Lb.	.. — .75

Organic.

Acetanilid, C. P.	Lb.	.. — .53
Acetic Acid, glacial, carboys, f.o.b. Shawinigan Falls	Lb.	.. —.22½
Acetic Acid, glacial, bbls., f.o.b. Shawinigan Falls	Lb.	.. — .22
Acetic Acid, 28%, carload lots	Lb.	.. —.04½
Acetic Acid, 28%, 25 bbl. lots	Lb.	.. —.05¼
Acetic Acid, 28%, 15 bbl. lots	Lb.	.. —.05½
Acetic Acid, 28%, 10 bbl. lots	Lb.	.. —.05¾
Acetic Acid, 28%, 5 bbl. lots	Cwt.	.. — 5.85
Acetic Acid, 28%, 3 or 4 bbl. lots	Cwt.	.. — 5.90
Acetic Acid 28%, 1 or 2 bbl. lots	Lb.	.. — .06
Acetic Acid, 80%, carload lots	Lb.	.. — .12
Acetic Acid, 80%, 25 bbl. lots	Lb.	.. — .14
Acetic Acid, 80%, 15 bbl. lots	Lb.	.. — .15
Acetic Acid, 80%, 10 bbl. lots	Lb.	.. —.15½
Acetic Acid, 80%, 5 bbl. lots	Lb.	.. — .16
Acetic Acid, 80%, 3 or 4 bbl. lots	Lb.	.. — .17
Acetic Acid, 80%, 1 or 2 bbl. lots	Lb.	.. —.17½
Acetone, pure, drums or over	Lb.	.. —.19½
Acetone, pure, lesser amounts	Lb.	.. — .25
Aspirin, in 100-lb. lots	Lb.	1.00— 1.10
Alcohol, Absolute Ethyl, case of 1 doz 1-lb. bottle	1-lb. bottle	.. — 2.15
Alcohol, Absolute Ethyl, in steel drums of 10 gallons capacity	Imp. Gal.	.. —15.00
Alcohol, acetone, bbls. or over	Gal.	.. — 1.05
Alcohol, acetone, lesser amounts	Gal.	.. — 1.35
Alcohol, pure, bbl., 65% O.P.	Gal.	.. —10.50
Alcohol, methylated, bbl.	Gal.	.. — 3.50
Alcohol, wood, 95%, bbls. or over	Gal.	.. — 1.15
Alcohol, wood, 95%, half bbl. lots	Gal.	.. — 1.25
Alcohol, wood, 95%, lesser amounts	Gal.	.. — 1.30
Alcohol, wood, 97%, bbls.	Gal.	.. — 1.20
Alcohol, wood, 97%, half bbl. lots.	Gal.	.. — 1.35
Alcohol, wood, 97%, lesser amounts	Gal.	.. — 1.50
Amyl acetate, technical	Gal.	4.50— 5.00
Amyl acetate, pure	Gal.	5.50— 6.00
Benzaldehyde	Lb	1.35— 1.60
Benzoic Acid	Lb.	.. — 1.00
Caffeine, English	Lb.	.. — 8.40
Calomel (Mercurous Chloride)	Lb.	.. — 1.26
Camphor, refined, slabs	Lb.	.. — 1.23
Camphor, refined, tal	Lb.	.. — 1.30
Carbolic Acid, white crystals	Lb.	.57— .75
Chloroform	Lb.	.60 — .65

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TABLE OF CONTENTS

Page

EDITORIALS.

F.C.I.C. and A.C.I.C. 26
Libraries for Research Workers 26
Vanity 27
The Broke Hustler 27
Knowing Our Own Resources 28
Direction 28

CORRESPONDENCE:

Letters to Editor 28
A Review of the Work of Ernest A. Le Sueur—Article II. By L. E. Westman 29
Production of Iron and Steel in Canada, 1921 32
The Present Trend of Chemists and Their Work. By F. J. Hambly 33
Economic Mineral Resources of Northern Saskatchewan. By W. A. MacLeod 35
Yukon Territory News 37
Carbon Black—A Review of Its Industrial Uses and Possibilities of Production in Canada 38

Page

CHEMICAL SOCIETY NEWS:

Unexpected Visit of M. Ch. Moureu to Montreal.... 38
New Members of Canadian Institute of Chemistry .. 39
Nominations for Council of Canadian Institute 39
Ottawa Section, S.C.I., December Meeting 39
Toronto Section, S.C.I., January Meeting 40
Annual Meeting of American Metric Association, Toronto 40
Book Reviews 41
Overseas and Foreign Industrial News 42
List of Chemical Firms at British Industries Fair 43
Mining and Metallurgy in British Columbia 44
British Columbia Industrial Items 46
Northern Ontario Developments 47
New Developments in Canada 47
Summary of Canadian Trade, 1921 48
Catalogues Received 48
Market Report with Specially Prepared Review of German Chemical Prices—By Our Berlin Correspondent 49
Market Prices .... 50.
Buyers' Guide 43
Classified Advertisements. 50
Index to Advertisers 52

FROM THE PUBLISHERS---

SHOWING YOUR CLASS

Sometimes very small actions enable others to classify you most accurately. When you feel that you are really getting up in your profession we believe that you will recognize that one of the chief distinguishing marks is the power of discrimination. The interrelationship of things becomes most obvious. You demand the best for yourself from yourself and others. Above all, you recognize the sterling efforts of those associated in particular and general ways with your business.

Just now, many chemists must show their class as individuals. They must meet trying conditions in their industries. Executives and salesmen are being put to new tests. Old records of success will not do for 1922. The rules of the game have been slightly altered. Errors in discrimination or judgment will no longer be covered easily. Those who succeed under present demands will know that they have been in action. Forward steps may be shorter. There will be less rushing to the top. Growth will be steadier. Moves in the business game will be more seriously considered. Do not these conditions mean opportunities for chemistry and chemists who are worth while? If you can think out a research problem, why can you not grasp the effects of infinite business details, relating to a desired object?

We know these things apply to the successful production of a technical business paper such as this. We invite your confidence in the discrimination we show in the selection of authoritative information for you, and we urge you to put spurs to yourself so that you may be numbered among those capable of achieving success in rough weather.

This stimulating thought is for the very faint-hearted only. "Why, this is Canada. You can't lose!"

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EDITORIALS

F. C. I. C. AND A. C. I. C.

THESE designations mean that the profession of chemistry is the life work of the holder and that the owner is, nine times out of ten at least, a Canadian. If you have the attainments and are proud of your profession and the possibilities of your country, it is reasonable to suppose that you will join in with others who aim to make the Canadian Institute of Chemistry the most important body of professional chemists in Canada.

The Institute has now the sole right to use these designations by Dominion Charter, and the qualifications they set up for membership are high enough to make this status a distinct honor.

Machinery is created, so that three grades of members are recognized, namely, Students, Associates and Fellows. From the initial decision to enter chemistry, anyone may become a member as a student. As attainments are secured, the rank of Associate may be reached, and, as a final mark of independent success in some particular line, the rank of Fellow is reserved.

The options for qualified Canadian chemists are three. They may join the Institute, using the Dominion-wide organization, which it has created, and play their part in it, becoming regular enthusiasts about matters which are vital to their success in a broad way. They may create some type of machine better than the Institute for this purpose, or they may hold back and plow a lonely furrow, nursing a perpetual mental canker, which may eventually dwarf their careers, leaving them unfitted to represent properly such a growing profession.

For those who have a natural disposition to stand aside and alone, and are not particularly well developed in their professional social instincts, the work of the Institute would make an extremely good tonic. A great number of the leading chemists of Canada are now members and others are joining rapidly. Wide-awake students in our Universities, who value this association with leaders in their profession are forming and joining student branches. We foresee a time when practically all chemists with the qualifications will be members, and when the industrial world will judge the rank of the chemists they employ as much according to this measure as by any other.

The letters F. C. I. C. and A. C. I. C. stand for something in Canadian chemistry. If you have the right to do so—use them.

LIBRARIES FOR RESEARCH WORKERS.

FACILITIES in even the largest centres in Canada are totally inadequate for the requirements of those wishing to follow chemical subjects from the research standpoint. The original literature is either scattered or non-existing.

We have large libraries crowded with casual readers of fiction, history and sundry topics of general and special interest, but we are very lacking in reference facilities for advanced scientific work. Abstracts are not enough, and are at best makeshifts. When industrial progress or investment is at stake, all the original literature should be available.

The establishment of such facilities in a few of the largest centres would not be an expenditure that anyone would object to, and we believe that the Dominion Government might well aid and undertake such a movement. It happens that more than one member of the new Cabinet is personally well acquainted with this situation. The Premier himself, Mr. King, is a man whose degrees, including that of Ph.D., represent research ability and years of academic study. He must be well aware of the advantages to be gained from work done in reference libraries at Washington and larger American institutions. There have been several efforts made by scientific bodies in Montreal and Toronto in particular to make such a beginning in Canada, but little has resulted.

In the matter of books, we know of no university in Canada that begins to keep up to date with the standard works relating either to the theory or practice of chemistry and engineering as applied to-day. The same is true of original papers and publications. Some are found in one place and others with individuals. Partly completed sets are lying around in various corners. Anyone who wishes to do some real reading in chemical research in Canada must meet with heart-breaking difficulties.

If we had even a corner of any one of the several large libraries devoted entirely to scientific literature of this kind, where the principal publications could be found in entire sets and where recent books were available, it would be a great step in aid of research. A company may propose, with the best of intentions, to give one of their men time to read up in an exhaustive way on some point. Months may go by where hours should do, before he can be satisfied that he has secured all the information available. When the actual commercial value of such equipment is considered, it is obvious that we have been very tardy. Libraries have followed public demands, and while the majority in the community may not be interested in such matters, it should not be forgotten that the few are among those who will make to-morrow better than to-day, in an industrial sense at least.

The movement needs leadership and we hope the Dominion Government, through some suitable department, will undertake to supply the necessary coordination with everyone who could bring about such a desirable end. Canadian industries, both present and prospective, are worthy of this assistance and stimulation.

VANITY.

WE have read on the label of a certain sauce the certificate of an analyst PLUS his personal opinion of the qualities of the sauce. We see in street cars the testimonials of movie stars for certain toilet preparations PLUS statements as to their action upon the skin. These are trifles, but underlying these is the psychology of waste in finance and industry.

The analyst used his special knowledge when he certified as to ingredients. Both the analyst and the movie star were just individuals in their use or enjoyment of the articles. Yet both were probably paid highly for the use of their names in expression of opinions which were in fact of only individual worth.

We do much of our big business in the same way. We are forming the habit of deciding on huge expenditures by majority vote in popular elections—a very wide stretch of democracy. Shall we, or shall we not, buy a railway, a power plant or any other pig in a poke?

It appears perfectly proper to ask whether we are willing to pay the piper if qualified persons advise it, or to vote as to choice between qualified persons, but for the rank and file of an electerate to decide whether or not we shall do that thing is extremely dangerous from a ratepayer's viewpoint.

Yet despite the differences of opinion among specialists we are arriving at the decision of these things by majority vote. We would be as well off to decide it by tossing a penny. That is not democracy. It is shirking responsibility. It is largely due to the fact that we elect men to public office who are not qualified. The gift of the gab and the nerve to use it rank in the forefront of qualifications for public office.

Brothers, many of us have not the gift or the nerve. Some of us have let those who have use them, and those who have not cultivate them.

Let us not fear to get into public life.

One chemist was elected on December 6, 1921. Let's have more, and engineers, electricians, stonemasons, biologists, bookkeepers, school teachers—one more got there, bless her—fishermen and foresters. We are fairly safe on farmers, lawyers and doctors.

In the "mealin' place" of a New England village, the writer and his tablemates would, no matter with what varied starting points we began our conversation, have one who sat with us wind up with a philippic on local taxes.

You have noted that the writer can begin anywhere and wind up on real representative government!

THE BROKE HUSTLER.

THIS is the name of a publication of which the advertised price is "one sent upon request." This is the very worthy house-organ of the large pulp and paper interests located at Iroquois Falls, Ontario. It has occurred to us that the name has a most timely significance for a great many individuals. We believe it was chosen several years ago, and in no way refers to the somewhat strenuous period through which the paper industry has just passed. We are not clear as to the derivation of this group of words; but the continual vision of this cross-head on our desk has gradually come to be a peculiar stimulation.

Undoubtedly the fabric is badly broken and tangled up. Those who are familiar with the appearance of a paper machine when a "break" occurs may well see a remarkable parallel between this situation and the present state of business. There are those who are "hustling" to restart and get the tangled mass of twisted paper cut and torn away. All is feverish excitement. Most people respond to an emergency by either doing the right thing or wishing they could help.

The question is "Are we all hustling as if we were 'broke', even if the urge in some cases is not so great as in others"? The times require that not only do the "broke" hustle, but also the "unbroken", in order that the machine may be set running again, and the world of industry and life get squared away to normal living and progress.

PREMIUMS.

The day of teaspoons in baking powder is still with us; so the chemist is still expected to make a $2.50 determination and throw in a $25.00 piece of advice!

It would pay better to sell the advice and throw in the determination, but analysts have gotten into loose habits.

KNOWING OUR OWN RESOURCES.

SASKATCHEWAN is not noted as one of the mineral-producing provinces of Canada. It is, therefore, of peculiar interest to learn that perhaps the chief cause of this is the fact that we have not looked for minerals within her boundaries.

Ottawa gives up rather slowly, at times, her ancient rights to provincial resources. Saskatchewan is just entering the period where her development along this line will rest with her own government and her own technical men and engineers. In this issue, we have the pleasure for the first time of reviewing a short account of the work of Prof. W. G. Worcester, Ceramic Engineer of the University of Saskatchewan. Mr. W. A. MacLeod, Editor of Government Publications at Regina reviews the results of this brief but successful survey of the economic minerals of a small portion of Northern Saskatchewan. Coal; iron ore, oil shales, valuable paint materials, limestone and glass sand were among the discoveries made.

Evidence sufficient to encourage the belief that these minerals are available in quantity has been gathered, and it should not be long before the farmers of this province awake to the fact that a complete development of industries is possible. Where the mineral bearing northern portions of these Western Provinces begin to develop along with the Central and Southern agricultural areas, amazing possibilities, quite beyond the present average conception, will result. We believe the Government of Saskatchewan is well advised to investigate and develop as far as possible some of those resources which will make for all round industrial progress.

DIRECTION.

RECENT disturbances in financial circles have been illuminating. Apparently the qualifications for directorships have been those of name, and the name has been of value as a matter of purse. Upon name with purse the public hangs a lot— Shakespere notwithstanding.

We refer to this not as a rehash of oft-repeated gossip, but to hammer a truth home. If directors are to direct, they must have a technical knowledge of the business they are directing.

Why not technical directors?

Why is it we find large industries whose directors are completely ignorant of the scientific facts and principles upon which those industries are based?

We do not find able men bristling with ideas, masters of facts, with broad grasp of details, voiceless in the councils of control? Granted some voice, would it not be possible to use some of the frozen-up surpluses, rests, obsolescence and depreciation funds to build up business and prevent obsolescence or depreciation by properly staffed, adequately paid and equipped scientific control departments?

TOO MUCH PRESS AGENT.

A well known explorer is suing his press agent for exaggeration.

Do not chemists suffer somewhat from this lily painting in magazine articles?

When a chemist is engaged by an industry, is it not too frequently in the hope that he will make some marvellous discovery, worth about ten times his salary?

This attitude is doubtless due to over advertising.

One of its effects is the sort of sporting offer frequently made to consulting chemists that they carry on experiments and share in the proceeds without any guarantee that they will be paid, if there are no proceeds, regardless of the value or quality of work done.

CORRESPONDENCE

January 19, 1922.

To the Editor,

Canadian Chemistry and Metallurgy.

Dear Sir:—

In the Report of the December Meeting of the Toronto Section of the Society of Chemical Industry published in the January issue of "Canadian Chemistry and Metallurgy" a statement has inadvertently crept into the account of the meeting that may possibly be misinterpreted, and I feel sure you will be glad to have your attention directed to it. I refer to the statement that Prof J. W. Bain and the undersigned declared they "were able only to represent themselves" when acting on the Advisory Conference Committee on Engineering Legislation.

When the writer made the above statement he thought he had made it perfectly clear that this situation obtained only during the first few sittings of the Committee. As soon as the Committee began to make progress a meeting of the chemists in and about Toronto was called. This meeting, at which many members of the Canadian Institute of Chemistry were present, expressed itself unanimously in favor of the work of the two chemist-members of the above Committee and asked them to carry on Later, at a similar meeting, the Ontario Society of Professional Chemists was formed as a direct result of the report presented re Engineering Legislation by the two chemist-members. Well over a hundred replies from representative chemists from all sections of Ontario were received endorsing the work of the two chemist-members on the Legislation Committee. It is scarcely correct then, to say that Prof. J. W. Bain and the writer "were able only to represent themselves."

Faithfully yours,

E. G. R. ARDAGH.

[Editor's Note: We are glad to have this letter from Prof. Ardagh, as it supplements very properly our report of the December, Toronto meeting.]

A Review of the Work of Ernest A. LeSueur

Article II—Describing the Development of Successful Methods for Copper Extraction and the Commercial Production of Liquid Oxygen and Air*

By L. E. Westman.

IN 1892 LeSueur became interested in the problem of chemically extracting copper from the tailings of the Calumet and Hecla and secured a sample of the then tailings for experiment. This work was side-tracked in its infancy and it was not until the beginning of 1899 that he had time to give it proper attention.

Any process which should aim successfuly to extract the metal from these tailings would have to be extremely cheap owing to the very small copper content which, even in the nineties, was under half of one per cent. Any solvent that was used would have to be very cheap on account of the unavoidable losses of same entrained in the great bulk of muds.

Ammonia in Cooper Extraction.

Attention was naturally directed to the use of ammonia. The difficulty in this connection was that the copper was almost entirely in the metallic condition and as such quite insoluble in this reagent. The problem presented itself of devising some way whereby active oxygen could be delivered throughout the mass of mud, and it occurred to him that, as cuprous oxide was readily soluble in ammonia it ought to be possible to effect the oxidation of the comminuted native copper by treating the tailings with an ammoniacal solution of cupric hydrate which might, if the spirit moved it, give up half its oxygen to the metallic copper so that the solution, even without the absorption of additional oxygen, might ultimately carry double its original amount of copper, all in the cuprous form.

If this could be done in sufficiently dilute solution and with reasonable rapidity, the problem would be solved because nothing could be simpler than the extraction of the increment of copper from the solution as well as the re-oxidation of the cuprous contents of the ammoniacal solution by mere exposure to the air, the avidity of ammoniacal cuprous hydroxide for oxygen being intense.

The Success of Ammonium Salts.

The experiment was made and resulted in complete failure, and in searching the horizon for any possible scheme that might promote the reaction, the chemistry and thermochemistry of which were both so reasonable the idea struck him that he would, for luck, throw in a little nitrate of ammonia. There might be a chance in a million that the nitric radicle would act as a carrier of oxygen from the cupric oxide to the metallic copper. So he made the trial and its success was immediate and astonishing. Indeed the speed with which a very dilute and cheap solution of cupric hydroxide and ammonium nitrate dissolved the first half of the copper in the sands was in the neighborhood of seven minutes.

The method adopted for ascertaining approximately the above speed was to carry on the treatment in a flask less than half full of the mixture and to connect to said flask, which was stoppered, a vacuum guage in the form of a small U tube containing mercury. As the copper went into solution by reducing the cupric hydroxide there followed an absorption of oxygen from the air in the flask. Obviously this absorption could not take place synchronously with the formation of the cupric hydroxide but followed it at some unknown interval of time. In other words it was certain that the time required for a given amount of copper to go into solution was less than that required for the absorption of oxygen sufficient to form cupric hydroxide with said amount of copper. The average of a number of experiments showed a time of less than ten minutes to elapse between the commencement of an experiment and the point at which, judging by the vacuum guage, oxygen sufficient to oxidize half the total copper content of the sample to the cupric form was absorbed. It was estimated from this that seven minutes was a very liberal figure (in connection with these particular tailings) for the time necessary for dissolving half the copper in the metallic form. There was also a small portion present as oxide which went into solution without demanding initial oxygen.

The above explains how it occurred to LeSueur to add ammonium nitrate, but the mechanism of the reaction was far other than what he had imagined it might be, because he presently found that any salt of ammonia acted about equally well. In those days a knowledge of the advantages of high ionization in a solution required to perform the functions requisite in such a connection was not very general. LeSueur took out a U. S. patent (No. 755302, applied for in 1899) in which the above process, as well as reference to means for extracting the copper increment and revivifying the solution were described. Later (in 1904) he experimented on a preferred method of extracting the copper by treating the solution with carbon dioxide, so as to throw down carbonate of copper and leave the ammonia in the solution in the form of bi-carbonate. The carbon dioxide would be obtained by burning limestone and the solution revivified by treatment with the resulting lime.

Application by Calumet and Hecla.

The matter was originally taken to the attention of the Calumet and Hecla, in Boston, in 1899, and was given much consideration. However, it was a time of very high prices for copper and the conclusion was reached that the Company would do better for the time by bending all its activities towards getting out the maximum possible tonnage of copper, even if in a somewhat wasteful way, and cashing it for what it would bring, than to divert energy to building and operating the elaborate and expensive outfit necessary to carry out the economies which LeSueur's process would enable.

After a lapse of some fifteen years, Mr. Benedict, chief chemist of the Calumet and Hecla, revived the process and the Company installed a large quantity of unique and expensive plant to deal with the matter commercially. LeSueur's patent had only a relatively short time to live and in view of this fact the sum he received for it from the above company was very substantial.

The Liquefaction of Air and Oxygen.

Late in 1899 LeSueur directed his attention to the commercial separation of oxygen and atmospheres rich in that element by the instrumentality of liquefaction. Excellent work along these lines had already been done by Linde, Hampson and others, but they had all employed very high pressures in order to bring about the extremely low temperatures necessary to secure the desired liquefaction. Another thing was that they had all assumed it to be necessary to start with liquid air in order to produce, by fractional distillation from it, gaseous mixtures weak in oxygen, and a final liquid rich in oxygen which, when vaporized, gave the desired product.

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*For the work of Le Sueur on the development of electrolytic cells, the reader is referred to previous article in this journal, January, 1922, p. 5.

The Work of Dewar.

The reasons which converged to foster this belief were curious. The idea naturally suggested itself that a fractional condensation from air would be richer in oxygen than is air. However, neither the work done by the above mentioned investigators nor that of Prof. James Dewar bore this out. Dewar submitted what he believed to be a final proof of the incorrectness of this view and it is not too much to say, whatever distinction he may have won in other directions, that his alleged proof would have been unworthy of any ordinary experimentor in his teens.

It will be obvious that the condition requisite to secure a fractional condensation from a mixture of gases, one of which has by itself a higher liquifying point than the other, is that the mixture shall be exposed to a temperature somewhat above that necessary to cause complete liquefaction. If it is childish to point out that such fractional condensation, in the case of air, is not consistent with complete liquefaction at a temperature well below the boiling point of liquid air, that nevertheless was the condition established by Dewar.

What he did was to take a flask full of air, and withdraw from same, into a downwardly pointing tubular extension with closed bottom, a fraction of the whole and liquefy it by exposure of the lower part of said tube to a temperature not merely as low as the boiling point of liquid air, or even as that of the lower one of liquid nitrogen, but to that of the latter liquid boiling under a partial vacuum, the remainder of the original mass of air remaining at room temperature.

The remarkable thing is that he accepted the result (which was that the composition of the liquefaction thus violently obtained was that of air) as a proof that a fractional condensation from air is the same as the latter in composition and that in consequence the only practicable starting point from which to secure liquid oxygen was liquid air.

The Fundamental Work of LeSueur.

LeSueur was the first to devise the following very simple proof that a liquid twice, or more, as rich in oxygen as is air, can be directly condensed from air. He immersed the lower two-thirds or so of an empty uncorked test tube in a bath of liquid oxygen and nitrogen having a composition considerably richer in oxygen than is air and a boiling point consequently higher. After a short time examination revealed that there was a drop of liquid in the tube. Analysis showed this to be of a compostion much richer in oxygen than is air, and, as he pointed out, this must necessarily be true because of the fact that nothing as rich in nitrogen as air could liquefy at a temperature above the boiling point of liquid air. The method he adopted to isolate the drop for analysis prior to vaporizing it was simple and effective.

LeSueur's Rule for High Pressure Condensation and Distillation.

A law relating to the behavior of mixtures of oxygen and nitrogen, discovered by him in 1900, sheds light on the reason why the practical workers (Linde, Hampson et al.) did not see from their own results the falsity of Dewar's conclusion.

The law may be stated as follows: "The higher the pressure under which fractional condensation occurs from air the poorer in oxygen is said condensation," and, conversely, "the higher the pressure under which fractional distillation occurs from a liquid mixture of oxygen and nitrogen the richer in oxygen is said distillation."

The results of this law are as follows: On the one hand, working at the low pressures that Dewar did in his abovementioned experiment, a fractional condensation from air is richer (initially very much richer) than is air, only, as above, Dewar did not secure a fractional condensation, but a complete liquefaction.

On the other hand, Linde et al. had secured their liquefactions under very high pressures, usually far above one hundred atmospheres, and the incidence of the above law determined the composition of the liquid, even when only fractionally condensed, as not remarkably different from that of air; and the said law being unsuspected up to that time, the above authorities, whatever their views may have been as to the validity of Dewar's demonstration considered on its merits, found nothing to quarrel with in the conclusion he drew from it.

The fact that a fractional condensation from air at moderate and low pressures is rich in oxygen lies at the foundation of the process for separating oxygen by mechanical means developed by LeSueur.

The old investigators had employed the extravagant pressures they did because of relying solely on the Joule-Thomson effect (in virtue of which compressed air, expanding through a porous plug or its equivalent, cools slightly, whereas a perfect gas would experience no change in temperature, and hydrogen, on the other hand, except under peculiar conditions of initial temperature and pressure, rises in temperature) in order to secure, in connection with the regenerative counter-current system, the necessary chilling effect.

The Development of Mechanical Equipment.

LeSueur was the first to employ the fairly obvious, but technically difficult, scheme of abstracting intrinsic energy from the working fluid by forcing it to do work in a motor Sir William Siemens had attempted this some time previously, but had made heavy weather of it, and LeSueur was able to secure a fall in temperature faster than the thermometer could follow (that is, in less than five minutes) to a lower point than Siemens reached after many hours as a limit. On the other hand, the enormous drop necessary for practical working was anything but plain sailing. The first 200° was almost immediate, the next 150° came hard, but was, nevertheless, finally secured.

The mere production of liquid air, or liquids rich in oxygen, was extremely simple and easy. It was getting the apparatus to run under moderate compressions of around ten atmospheres and securing liquefaction of even a portion of the air directly in the main apparatus (whereby it was made possible to separate the air into a rich liquid portion and a poor gaseous residue) that was a tremendous business.

Liquid Air by the LeSueur Process.

The method LeSueur employed to produce liquid air was, first, to run the main apparatus (which was, in brief, a large thermal counter-current system provided with a motor at its low temperature end through which the cold, compressed air was expanded) until the exhaust from the motor was around 240 degrees below zero F. and then start a small compressor which drew air compressed already to about ten atmospheres and raised its pressure to about forty atmospheres. The compressed air was passed downward in temperature through a small thermal counter-current system, and, after leaving the low temperature end of said system, passed through a copper coil situated in a sheet metal drum through which passed the exhaust from the motor above mentioned prior to said exhaust starting upwardly in temperature through the main counter-current system.

The small compressor withdrew and compressed about one-tenth of the delivery of the main compressor A portion of this was liquefied (under about forty atmospheres) and collected in a suitable vessel from which it was withdrawn continuously or otherwise as required, the gaseous residue passed back through the small counter-current system to ordinary temperatures again.

By this means some tons of liquid air and other liquid mixtures of oxygen and nitrogen were produced.

Obviously these liquids had no direct bearing on the commercial production of gaseous oxygen because, with a view to the cheap preparation of the latter, it is necessary to economize the chilling effect of high intensity possessed by the liquid mixtures to the utmost degree possible and not withdraw them from the apparatus as such, but, having secured the necessary separation of a liquid rich in oxygen at the low temperature end of the main counter-current system, to force it to restore to said system as fully as possible the chilling effect possessed by it. That is to say, to cause it to absorb its latent heat of vaporization, and as much sensible heat as possible, from the down-flowing stream of new air in passing back through the counter-current system to ordinary temperatures again.

There were a number of intensely interesting investigations for which the liquids as such were essential. In addition to filling these requirements LeSueur made use of said liquids to overcome a most peculiar difficulty (when using a turbine) which was encountered in working for fractionation of the main air stream.

The motor used at Sault Ste. Marie, where the original work was done, was a single-effect turbine, and it worked well until the temperature of its exhaust fell nearly to 300 degrees below zero F. and then the process was hit with a blizzard of carbon dioxide snow, which plugged both its nozzles and guides. LeSueur adopted the scheme when this occurred of shunting, from a point comparatively high up in the counter-current system, "warm" air at about 100° below zero through the nozzles for a few seconds (which caused an almost instant volatilization of the solid carbon dioxide) and then temporarily shutting down the apparatus and pouring into the drum which received the turbine's exhaust what he called the "priming charge," consisting of a couple of hundred pounds of liquid air, and immediately starting up again.

The result of this was that this charge found itself in contact with the outsides of a set of pipes conveying the cold compressed air to the turbine with the result that the carbon dioxide in said air (or sufficient of it) was frozen out before the latter reached the nozzles. The passages for the compressed air were of large capacity so as to accommodate considerable amounts of solid carbon dioxide.

When it is borne in mind that the air employed was extremely pure, being drawn on the shores of Lake Superior, and contained not more than about three parts by volume of carbon dioxide to 10,000 of air, it will be seen how remarkable and unexpected the above difficulty was. The actual priming charge employed was completely vaporized in a very few minutes, but its place was taken by fresh liquid whose condensation was induced by the absorption of latent heat of vaporization by the said priming charge.

Once fractional condensation of a liquid rich in oxygen had occurred, there was no novelty over previous work in the methods adopted for further strengthening the oxygen. This was done by well known rectification methods, the heat required to vaporize the final (rich) liquid being supplied by the latent heat of vaporization of the condensing fraction of the compressed air on its way to the turbine.

Liquid Oxygen.

To recapitulate, a liquid rich in oxygen was condensed from a fraction of the total compressed air employed and at the same time there remained a large, unliquefied, compressed residue weak in oxygen available for securing refrigerating effect by giving up a portion of its intrinsic energy to the turbine; and upon this dual principle depends the present most widely used process for the production of commercial oxygen. This is commonly known as Claude's process, but LeSueur discovered and worked it first.

Claude's authoritive book describes the weary road he travelled up to 1902 in connection with this problem. He mentions May 26th, 1902, as the date at which he first got his apparatus to separate oxygen from air directly in the main system in the method described above and states that, while it took him several years to reach this point, he would never have done so at all had it not been for the "precious advice and encouragement" of the great physicist d'Arsonval. LeSueur reports that he had noone's advice and encouragement to rely on, but, on the other hand, received more or less direct as well as implied criticism for taking so long to get his apparatus to operate properly.

He commenced work in the last days of December, 1899, and, after trying out and abandoning a modification of the high pressure methods, got his new apparatus working as above described early in 1901.

Claude speaks very generously of LeSueur in his book and makes reference to the "very interesting" patents issued to the latter and to "LeSueur and other authorities," and of himself having, without knowing it, been anticipated in the theory of the rich fractional condensation by this "erudite Canadian."

Motor Problems.

With reference to the function of the motor at the low temperature end of the apparatus, its virtue obviously lay in its rejection from the process of the heat equivalent to the mechanical work developed. This work might be used for useful purposes and be so much to the good, but the great thing was to get it away from the process. LeSueur first used a turbine revolving near the lower end of a vertical shaft which carried a centrifugal pump impeller near its upper end, working in water, and the stream of the latter under pressure thereby obtained was, after passing a throttle valve, run through a cooling coil immersed in the water of a calorimeter tank by which measurements were readily made. Space forbids a description of the means employed to prevent the hot water in the pump case from running down into the intensely refrigerated turbine but, after some weary weeks of changes and adjustments the said means were made fully satisfactory.

Another type of motor was afterwards used at Pittsburg in the form of a straight line compound engine especially designed with extra valves and valve ports owing to the great density of the working fluid at the low temperature of operation. LeSueur had already ascertained that there were unusual difficulties connected with the use of the D slide valve, but, on the other hand, the balanced (cylinder) type of slide valve gave excellent results. The engine was, for certain important reasons, of the vertical type worked horizontally by being laid on its side. Getting this apparatus to work satisfactorily had its own serious difficulties, but in the end these were overcome and a higher mechanical efficiency was obtained than when using the turbine. In the case of the engine the work was delivered to a belted d.c. generator and the rate of energy output could be read at any moment on a wattmeter. Perhaps the greatest trouble with the later apparatus was connected with packing the piston rod and valve rod glands, but a form of metallic packing finally gave good results. Another difficulty, quickly overcome, arose from the fact that it was found that a change downward of a few hundred degrees of temperature had a much greater effect in distorting the true cylindrical bores of the cylinders and valve chests than the same change upwardly. The consequence of this distortion was to cause the pistons to jam in the cylinders. No lubrication was attempted, nor did any mechanical trouble arise from this lack, and LeSueur ascribed this to the fact that the rubbing surfaces got almost glass hard at the low temperatures of operation. Some hundreds of thousands of cubic feet of oxygen and atmospheres rich in oxygen, as well as many of tons of liquid air which was withdrawn from the machine as such, were produced in this apparatus.

In 1918 LeSueur assigned his Canadian patents, which had, of course, almost run out, and which were the only surviving ones in connection with this matter, to Claude's company, for, under the circumstances, an excellent cash consideration, and also entered the consulting staff of this world-wide and world-famous organization—Societe l'Air Liquide.

It will be seen that in both the copper and oxygen processes LeSueur was ahead of the time, but, far from this being a misfortune, it was only because he was ahead that he secured patent rights which he was able, years later, to dispose of to advantage.

This article brings LeSueur's activities down to 1905, in which year he finished his Pittsburg oxygen work, the latter done while on the private experimental staff of the late George Westinghouse. Since then he has been mostly engaged in connection with the commercial electrolytic preparation of chlorates and perchlorates and with explosives, of which latter he is the inventor of a line of powders which have, in the hands of contractors and others, taken out millions of tons of rock at points clear across the Continent from the St. John River, in New Brunswick, to the North Pacific Coast.

It is the author's hope, in a further article, to give a more particular account of these developments, although as a number of them have been confidential, it is not possible to cover them fully. In the meantime it may be of interest to note that LeSueur was the first in this country to manufacture and ship TNT. This was in the Spring of 1915, and a shipment of 25,000 lbs. was passed by an inspector for the Minister of War for Belgium in early May. This manufacture was the more interesting on account of the makeshift apparatus which necessity forced on him in order to expedite the delivery of the goods. The work was done on the shores of the Bay of Quinte, on Lake Ontario, adjoining the ground that later became Camp Mohawk Aviation Field.

PRODUCTION OF IRON AND STEEL IN CANADA, 1921.

The average monthly output of pig iron in Canada during the twelve months ending December was 50,000 tons, or less than the average monthly record for any year since 1908. Throughout the entire year during which a total of 595,000 long tons of pig iron was made, the market was decidedly quiet and the suspension of interest in iron was general. In the United States as in Canada the final week of 1921 was characterized by a quiet market and declining production. In spite of this there was evidence at the close of the year that there would be an early resumption of activities in the iron trade and the opinion was generally expressed that the first month of the new year would see the beginning of an upward movement in production.

Steel Ingots and Castings.

During the twelve months ending December, 667,484 long tons of steel ingots and castings was produced as compared with 1,109,000 tons made during 1920. The average monthly production during the year just closed was 56,000 tons as compared with 92,000 tons during the preceding year. Of the total production of steel ingots and castings during 1921, 645,075 tons was in the form of direct steel ingots comprising 641,882 tons of basic open hearth steel, 239 tons acid open hearth steel, 94 tons bessemer, and 2,860 tons made in electric furnaces. The whole basic and acid open hearth production of steel ingots was made by the operators for the use of their own mills. Of the bessemer ingots produced 37 tons was used directly and the balance was produced for sale. A total of 2,200 tons of electric steel ingots was used by the plants reporting and 660 tons was made for sale.

Steel castings produced during the year amounted to 22,409 tons, comprising 6,531 tons basic open hearth, 256 tons acid open hearth, 1,638 tons bessemer and 13,984 tons castings made from electric furnaces. Of the whole amount 18,495 tons was made for sale and 3,914 tons used by the firms reporting. An analysis of the 18,495 tons of direct steel castings made for sale shows 5,081 tons was made by the basic open hearth process, 252 tons in acid open hearth furnaces, 1,401 tons by the bessemer process and 11,761 tons from electric furnaces.

The low price of steel in December was not only the low for the year but was lower than at any time since January, 1916. While the production of steel during 1921 was less than for any preceding year since 1908 the sentiment prevailing in the steel trade at the end of December was favorable to an early resumption of activity and the hope was everywhere expressed that the early months of the new year would be marked by a resumption of construction work, as a result of the more favorable purchasing market established, and that as a consequence a considerable development in the production of steel might be expected.—Abstracted from Report of Dominion Bureau of Statistics, Ottawa.

25 TONS OF "NICKELS" PER YEAR.

The Royal Mint, Ottawa, announces that the new coinage made from pure Canadian nickel will, at the beginning, average about 25 short tons per annum. This is not a very large consumption; but the result will be a new general appreciation of the value of this metal. Coin shapes, carried for years, show practically perfect wearing properties, and the idea of giving this publicity to one of our most important metal resources is excellent.

The Present Trend of Chemists and Their Work*

The Relation of Pure and Applied Chemistry Discussed and Opportunities for Research Mentioned—Educating the Public to Appreciate the Chemist.

By F. J. Hambly.

PRIOR to 1914 civilized countries were content to accept with indifference the localization of certain chemical and other manufacturers in particular countries. On account of the adaptability of the plant required for the production of synthetic organic compounds, including dyestuffs and pharmameuticals, to the manufacture of explosives and materal for chemical warfare, no one country can in future be allowed to monopolize such manufactures, as it is now realized that such a monopoly is potentially as dangerous as one for the manufacture of ordnance and explosives. If the demand exists, it is comparatively easy to manufacture any chemical product on a large scale sufficient to meet a demand vastly in excess of any peace time requirements, but the question at once arises as to how to find a market for such products. In commercial chemistry to-day, the position is that while the world demand for certain chemicals is less, rather than greater, than in 1913, Germany, France, England, Switzerland, Scandinavia, the United States, and Canada all possess a super-abundance of chemical plant which cannot possibly be used for peace-time requirements.

Another result of our war experience was the demand for chemical engineers for plant construction and superintendence of the plant built, and that to-day our university courses in chemical engineering are over-crowded while the course in pure chemistry and correlated subjects are comparatively neglected. This condition can only be temporary, as the progress of industrial chemistry in the future, as in the past, is ultimately dependent upon the study of pure chemistry in its many specialized divisions.

Relation Between Pure and Applied Chemistry.

This frequently discussed relation between pure and applied science is clearly stated by Prof. J. Arthur Thomson, in his recent book, "Science for Life," from which the following paragraph is quoted:

> "The lesson of history is clear; if any really big changes are to come about, it is likely to be through discoveries in Pure Science, and the priceless people are those who have brains enough to be discoverers of Pure Science. There is, of course, nothing but good in applying the results and methods of Science to immediate difficulties and limitations: the danger is of a false valuation, of ignoring the lesson of history that, even for practical ends, it is theory that pays, and of diverting the real discoverer from the quest of understanding. No question arises as to the role of inventors who devise some useful application of a new knowledge which the discoverers have established, but the danger is letting inventors overshadow discoverers. A thousand people know of Marconi, for one who knows on whose shoulders the Italian inventor nimbly and with perfect fairness perched himself. Ten thousand people know of Edison for one who has heard of Willard Gibbs."

In addressing the members of the Society of Chemical Industry, the first object of which society is "To promote and advance Applied Chemistry and Chemical Engineering," no apology is offered for emphasizing the initial subsidiary importance of Applied to Pure Chemistry, as a glance over the list of Presidents of the Society amply proves that the principle has always been accepted and acted upon by the Society.

The Importance of Bio-Chemistry.

Many of us have recently had the privilege of attending, for the first time, an annual meeting of our Society held in Canada, and those who did not have the pleasure of hearing Sir William Pope's address in Montreal have since read it in the Journal. From this highly suggestive address I quote the following extracts in relation to this evening's subject:

> "That the achievements of synthetic organic chemistry by laboratory methods have led chemists to give more attention to these methods than to those taking place all around us in the living animal and plant . . . that the great majority of chemical re-actions which take place in living matter occur catalytically in colloidal media . . . it is impossible to doubt that a vast expansion of organic chemistry will be witnessed by many of us, an expansion which will result from an imitation of the gently effected chemical operations carried out in the animal and vegetable creation."

It is also significant that coincident with our meetings in Montreal the British Association was meeting in Edinburgh and the subject selected by Dr. M. O. Foster for his presidential address to the Chemical Section was "The Laboratory of the Living Organism," which was followed by a joint discussion in the sections of Chemistry and Physiology, "On Oxidations and Oxidative Mechanism in Living Tissues." A careful reading of the reports of this address and discussion is strongly recommended to all interested in the present trend of chemical research.

Of direct interest to Canadian chemists, it is to be noted that Dr. A. B. Macallum, who for some years past has given his whole energies to the problem of organizing scientific research in Canada, has resigned his position as President of the Canadian Research Council, to accept and inaugurate a new professional chair of Bio-Chemistry in McGill University.

Recent work in organic, physical, and colloidal chemistry is evidently converging upon a more real knowledge of problems which have fascinated chemists since the time, now nearly a century past, when Wohler, in 1828, synthesized urea from ammonium isocyanate. The magnitude and importance of many of these chemical processes going on all around, and within us, is too often lost sight of by many chemists whose specialized work in the laboratory too often obscures the wider vision, which it is the object of our meetings, conventions, and journals to stimulate and promote.

The best known of Nature's synthetic products is one which we all use daily in a state of 99.9% purity and obtainable retail, at a pre-war price of about 5c per lb. While the extraction of cane sugar from the cane and beet, affords a striking example of the methods of applied chemistry, the scientific study of the chemistry of cane and other sugars was rendered possible in 1886 by Emil Fischer's discovery of the sparingly soluble compounds which sugars form with phenyl hydrazine. Notwithstanding Fischer's subsequent brilliant investigations of the sugars, how much, or how little, do we yet know as to how the plant produces sugar by the aid of solar energy from carbon dioxide and water, and of the further transformation of these sugars into starch and cellulose?

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*Address delivered before Ottawa Section, Society of Chemical Industry, November 10, 1921, by Fred J. Hambly, F.I.C., Chairman, General Manager, Electric Reduction Company, Ltd., Buckingham, Que.

Great Fields of Investigation Not Yet Developed.

The cellulose industries, of which the primary products are pulp and paper, are of special interest to Canadian chemists, and recent developments of colloidal chemistry indicate that in this connection the field is ripe for continued investigation.

A suggestive paper on the "Fundamental Chemistry of Cellulose," by Dr. J. Macdonald, read in September last before the technical section of the British Paper Makers Association, is worthy of note in this connection.

The compounds obtainable by the breaking down of cellulose, starch, and sugar by the action of ferments are also destined to become of even greater importance in the future. Sooner or later the internal combustion engine must become dependent upon industrial alcohol for its motive power.

The nature of catalysis is one intimately related to the action of ferments, the enzymes of which are probably closely related to the vitamines, further knowledge of which forms one of the immediately pressing problems of animal nutrition.

In other branches of our science, that of electro-chemistry, may be mentioned; while important progress has been made during the past thirty years in the utilization of electrical energy in chemical processes, the conversion of chemical into electrical energy has made but little advance during the past century, but it can scarcely be doubted that the conversion of the potential chemical energy of fuel into electrical energy can be accomplished without passing through the wasteful circuit of the heat engine.

The applications of discoveries already made may be left to industrial laboratories, which laboratories will increase in importance as the passing generation of employers and boards of directors becomes replaced by men having a wider knowledge of what may be accomplished by laboratory investigation and control. Some of the larger industrial organizations, such as the General Electric Co., and Eastman Kodak Co., in the U.S.A., are, as a commercial proposition, carrying on investigations in "pure" science, in addition to those for commercial development of scientific discoveries; but in general, the main source of research work in "pure" science must be in our Universities, supplemented and aided by Research Institutes maintained by the State.

The Chemist and the Public.

There is an increasingly wide field before us for research work, but what are the inducements to attract the student entering our universities to take up the science of chemistry as a profession comparable to those in Medicine, Law, or even Dentistry?

The extraordinary feature of our position to-day is, that not only in Canada, but also in Great Britain and the United States, the general public does not even know what a chemist is. In Canada the only persons legally entitled to call themselves "Chemists" are those qualified under the various provincial pharmacy acts to dispense poisons—for example, the Quebec Pharmacy Act, R.S.P.Q., Art. 4999, Sect. 11, defines as follows:

> "The words 'druggist,' 'chemist,' 'apothecary,' 'pharmaceutist, 'pharmacist,' 'pharmaceutical chemist,' or 'dispensing chemist' mean a person having the right to sell and compound drugs and poisons in this province."

Chemists in Ontario have become so discouraged with this aspect of the situation that they have actually formed an association which proposes to abandon the title of "Chemist" for that of "Chemical Engineer," and by association with other branches of the engineering profession to promote legislation in Ontario to make engineering a closed profession. Chemical Engineering is an important branch of engineering, but to designate all chemists as chemical engineers is not a solution of the difficulty, and can only result in producing further confusion in the public mind as to the province of chemistry and the work of the professional chemist.

Instead of attempting to penalize the use of chemical knowledge by other than members of Provincial Associations of professional chemists, it should be our object to create such an appreciation by the general public of the aims and objects of chemistry, that the services of professional chemists should be sought in many matters in which, at the present time, the possibility of such services possessing any money value is not even recognized. A somewhat analagous position is that now occupied in the commercial world by the Chartered Accountant. While a common school education gives every person a knowledge of arithmetic sufficient to keep more or less complete records of receipts and expenditures, the conduct of even a small business requires the keeping of accurate books of account and the employment of a person who has made a further study of accounting; but when an authoritative statement of such accounts is required for partners, shareholders, bankers, and others, it is now demanded that such accounts be examined and certified by a chartered accountant, whose special qualifications are certified by a legally incorporated society of accountants. The growing recognition of the importance of scientific accounting has not been obtained by direct legislative action, though it will in all probability be so recognized in the near future.

The history of the Institute of Chemistry of Great Britain and Ireland over the thirty-four years of its existence indicates that the recognition of professional chemistry in Great Britain is proceeding on similar lines. Though founded in 1877 the Institute has not attempted to make chemistry a closed profession, though its qualifications are now recognized by the British Government in connection with official chemical appointments. In view of the widely spread relations of chemistry to the arts and manufactures it does not seem possible to restrict the practice of professional chemistry in the same manner as that of Law and Medicine, as the demand for the services of professional chemists can only develop as the paying public becomes educated to its need of such services.

It is therefore difficult to see how the better public recognition of the importance of chemistry and the improvement of the position of the professional chemist can be attained other than by patient and persistent education of the general public. To this end a press propaganda on the lines so ably advocated by Dr. C. H. Herty and now carried on by the American Chemical Society, should be definitely organized and systematically promoted by Canadian chemists, and it is satisfactory to learn that action in this direction is now being considered by the members of our Society in conjunction with the Canadian Institute of Chemistry. Another line of attack should be the extension of the instruction in elementary chemistry and physics given in our schools to the point of making such knowledge a compulsory requirement for the school-leaving certificate, and for entrance to the Universities in any Faculty.

Coincident with this further education of the public, we as chemists must, by means of our Canadian Institute of Chemistry, set up such a standard of professional education and experience that membership of the Institute shall command public respect upon all matters relating to chemistry, such as, evidence in courts of law, qualifications for government and municipal appointments, and reports upon chemical problems in relation to the industries.

Economical Mineral Resources of Northern Saskatchewan

A Review of a Recent Economic Survey Disclosing Presence of Limestone, Ochres, Iron Ore, Coal and Oil Shales.

By W. A. MacLeod.*

THE economic, mineral and geological report on the reconnaissance survey of a part of Northern Saskatchewan, by Mr. W. G. Worcester, the Ceramic Engineer, recently appointed by the University of Saskatchewan, has been presented to Hon. C. A. Dunning, Minister of Labor and Industries. This report contains a study of the natural resources discovered and examined during the past summer, by the Saskatchewan Government party, while on a reconnaissance survey of the Lac La Rouge-Bear Mountain District. Mr. Worcester mentions that certain portions of the territory covered have been visited in the past by Dowling, in 1892, and Wm. McInnes, in 1908, for the Geological Survey, and Mr. Worcester acknowledges the value of the reports of McInnis, both in the field and in preparation of his own report.

Prince Albert to Montreal Lake.

The survey took place between the dates of August 3 and October 15, 1921, and Mr. Worcester begins by setting out the route followed from Prince Albert to Montreal Lake. This portion of the journey, however, offers nothing of mineralogical importance, and is dismissed with the statement that over the entire distance, approximately 90 miles, nothing was observed of any particular economical value, outside of agricultural or grazing possibilities, and even these should be looked into with much care, certain portions only being suitable.

Coming down the outlet from Montreal Lake the stream at first is sluggish, but after passing Squirrel Hill, where a fire rangers' tower is located and from which a magnificent view of the surrounding country can be obtained, the current increases, until with scarcely an interval for twenty-five miles the river rushes over rapid after rapid. Although there would seem to be a vast amount of energy going to waste in this part of the river, it has little to recommend it from an engineering point of view, on account of the low and marshy banks, the sandy soil, and the absence of proper anchorage for power dams.

Lac La Rouge.

Mr. Worcester regrets that more time was not available in which to study the possibilities or natural resources near this lake. However, during a brief halt on the south shore, near the mouth of the Bowtree River, a considerable quantity of coal, hard, bright and slightly water worn, was observed. In the time available it was impossible to get a convincing explanation of the occurrence of this coal in a comparatively fresh stage of preservation, and the outcrop could not be located.

In the same vicinity is an outcrop of buff limestone, which in Mr. Worcester's opinion is of the Devonian age, and corresponding to the dolomites of the Winnipegosis district. This stone will not only be of great value when a railway taps the district, but its fitness for plaster and mortar has already been shown by its use in the new Mission at Lac La Rouge. The plaster is very hard and of a suitable white color.

Here and there along the south-east shore line are beaches of yellowish white sand, and on these are considerable quantities of beautiful garnet sand, which finds a ready market as an abrasive material, especially in wood industries for buffing and grinding tool handles.

Wapawekka Lake.

This lake is in reality made up of two parts, the main lake to the west, and a long narrow lake extending to the east locally known as Pipestone Lake. At the Narrows between the two a week was spent in studying the cretaceous formations and in opening up and sampling the deposits of material found, which consisted of mineral water, ochres and umbers, paint clays, bog iron ore, carbonaceous sands, shales, fire clay, glass sands, coal.

Mineral Water.

At many points along the shore heavily charged iron springs were found, the water coming from an iron cemented coarse grained sand rock. "Possibly the only value," says Mr. Worcester, "which can be attached to the mineral waters at present is that through them the original source of the iron may be traced, and also that they have and are now depositing a large amount of material in the form of ochres and umbers which have an economic value as paint materials.

Ochres and Umbers.

Samples of these have now been tested at the University for permanence as paint material, and have proved "highly satisfactory, especially the ochre, which, upon calcination, developed a very fine, clear, vermillion red. The umber had 63.3 per cent. metallic iron and the ochre 47.1 per cent. The samples were above the average in purity and in view of this fact," says Mr. Worcester, "that the deposits are located over a very wide area, they may mean much to the mineral wealth of Saskatchewan."

Bog Ores.

Two-thirds of the iron ore used in Great Britain is siderite, a material carrying about thirty per cent. of metallic iron; the rich hematite ores of the Lake Superior district run from 51 to 55 per cent. metallic iron; bog ore collected on the north face of Bear Mountain shows by analysis 49 per cent. of metallic iron. The ores were found over a considerable territory and indications, says Mr. Worcester, are favorable for the finding of a large field. Should such be the case, the future importance of the bog ores to Saskatchewan is worthy of consideration.

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Shales and Fire Clays.

Along the shore of Wapawekka are found shales in such quantity and quality as to warrant their use in the manufacture of building and paving brick, hollow building tile, drain tile and similar lines, and at one point was found a deposit of a light grey silicious fire clay. Time has not permitted the making of refractory tests of this fire clay, but should it prove good, as is expected, Mr. Worcester states that its value to this particular section of the province, in the event of a mineral development can hardly be estimated.

Glass Sands.

Mr Worcester quotes the following analysis, taken from McInnis' report, of the glass sands found in the Wapawekka district:

Si O_2 (Silica)	98.60
Fe_2O_3 (Iron Oxide Al_2O_3 (Alumina)	1.20
Other impurities	.20
	100.00

Mr. Worcester goes on to say that "the value of such high grade glass sands, as a natural resource, to Saskatchewan cannot be computed in dollars and cents. It will take generations even to partially exhaust these vast deposits. Their value is further enhanced by the fact that the necessary flux (limestone) is known to occur in the Lac La Rouge Crystalline belt; furthermore there is good reason to assume that fuel will be found in close proximity."

Coal.

On the south shore of Wapawekka Lake a coal seam was traced from its first appearance three miles from some white cliffs to a point two and a half miles southward along the shore from the mouth of Muddy River. A certain point, where the bank was about thirty feet above the lake, was selected, where the coal outcrop at the start measured four feet one inch, with indurated sand above and below. Here some developing work was done, and by means of pick and shovel work, with the assistance of a little dynamite brought in at considerable risk from Prince Albert, a seam was uncovered with a maximum thickness of five feet two inches. (Three samples of this coal have now been analysed by the Chemistry Department of the University of Saskatchewan, with the following results:

	No. 1	No. 2	No. 3
Moisture	13.06	11.07	9.90
Volatile Matter	35.99	45.93	34.83
Fixed Carbon	21.50	15.63	35.34
Ash	29.45	27.37	19.93

"While it would seem," says the report, "that the thickness and quality of the above seam of coal would prove satisfactory for mining purposes, such an undertaking would prove impractical at this or any other point of outcrop along the East or South shore of Wapawekka Lake, because the loose, incoherent sand which lies immediately above the coal seam would prove a most dangerous roof, in fact the idea could not be entertained."

"The chief value of this outcrop along the shore of the lake is not monetary but it furnishes a possible clue to the location of the main field or deposit of coal." From his geological studies, the writer is of the opinion that the exposures represent only a marginal fringe of the main coal bed or field. In support of this marginal theory a number of arguments are advanced and conditions cited, leading to the assumption that the main field or deposit of coal lies to the south southeast, with a possible extension southwestward to the Bowtree River district. Mr. Worcester adds that it can only be by meanes of the drill that the above can be verified or disproved.

Carbonaceous or Black Sands.

"The outcrop of the Dakota formation," says the report, "or white sands along the lake shore for nearly three miles, shows a possible evidence of having been, at some time, impregnated with a carbonaceous liquid-like petroleum or bitumen. An analysis by the University of Saskatchewan gives:

Total loss on ignition	14.33%
Loss at 120 to 130 (water)	10.35%
Difference carbonaceous matter	3.98%

"The fact that these sands are associated with lignites in the Wapawekka district is significant. Certain formations are more favorable to the production or accumulation of oil or gas than others, and geologists agree that domes and anticlines are more favorable than synclines or depressions as storage reservoirs. In this connection it can be said that there are present in the district under discussion, both dome and anticline formations."

Mr. Worcester is of the opinion that there is a favorable possibility of oil or gas being found in this district, and supports this idea by the production of some interesting facts. He shows that a number of bore holes, made in an irregular line from southwestern Manitoba up to Wapawekka Lake, show that the Dakota formation has a very marked increase in elevation from south to north, and further that in the lower elevations is noted the presence of salty waters, while the most northern or high elevations present indications of oil. The salt water, having the heavier specific gravity would monopolize the lower sections, while the oil, or lighter material, would be crowded or forced into the upper levels, in this case northward.

The Muddy River.

On inspecting the Muddy river, the party were disappointed in their hope of finding exposures of coal in the cut banks. The last of the Dakota sandstones were seen six miles up the stream, which was followed for a distance of twenty-two miles into a rather open plateau country.

Pipestone Lake District and Pine River.

The only portion of the lake examined was its south shore, or that part adjoining the Bear Mountains. Here there is belt of schisto rocks of a grey greenish color, some portions showing small red specks of nodular iron, while others along the cleavage planes were stained with a film of red hematite. At one point the rock has the nature of talco schist, which is easily carved on first mining and afterwards hardens. This may be of value as a source of material for electric switch boards, laboratory table tops, sinks, and as a refractory for furnace linings. Along the Pine River, which is the outlet of Pipestone Lake, granites are first in evidence, giving way to a belt of schist rocks, greenstone and beds of nearly pure hornblend. Samples were taken, and Mr. Worcester states that this field offers a most favourable one for prospecting.

Wapawekka or Bear Mountains.

At a certain place close to where the party camped in these mountains, cliffs were noticed twenty-five to thirty feet high of evenly bedded, fine grained shale, silver grey where weathered but slate colored to black when freshly exposed. Another cliff with the same characteristics was noted further down an east flowing stream. This is sixty feet high and has layers strongly impregnated with iron and gypsum crystals. At still another point a lower cliff was found, where freshly exposed material was of very black color and of a well stratified, block formation, so that blocks up to a cubic foot could be pried out.

"The air at this point," says Mr. Worcester, "contained a very marked odor of petroleum, and upon breaking open blocks of the shale one could not mistake the characteristic odor. Samples were taken and the following analysis by the Saskatchewan University were given:

Oil per ton of shale	7½ gal.
Gas per ton of shale	1,893 cu. ft.
Ammonium sulphate	10½ lbs.

"There is no question but what this shale is the Benton, and represents the same formation of oil shales exposed on Carrot River, south of the North Saskatchewan. In view of the oil content as revealed by the sample, it is quite out of the question to think of using same for the production of oil at present, in face of the low cost of production from petroleum wells. Furthermore, while these oil shales may indicate the presence, or seepage of oil from an underlying pool, too much weight should not be attached to this. It is more than likely that the evidence of oil being present is due to the small per cent. evenly distributed throughout the dense shale. That these oil shales have been found so far north in Saskatchewan is of much value in the matter of future geological work as well as for possible commercial development.

"Outside of the possible oil values in these shales, their chief interest to the province lies in their use as material for the manufacture of clay products, and there are many feet of these shales of a character suitable for all structural clay ware."

Economic Materials.

The following is Mr. Worcester's summary of economic materials found:

"From Prince Albert to Lac La Rouge there was little on the line of travel to demand attention from a commercial point of view. While there are vast quantities of sand, it is low grade."

"At Montreal Portage the ochre and iron sands are worthy of further consideration."

"On the south shore of Lac La Rouge the limestone is of much importance. The evidence of coal at this point is sufficient to warrant further prospecting in this vicinity."

"The glass sand deposits on Wapawekka Lake are not only of value to North Saskatchewan, but are of great value to the whole province. They are of such quality that they will be sought for by the glass, pottery and other allied silicate industries."

"The evidence of iron was observed over a wide range, and while it was of the ochreous bog ore types, their metallic iron content is such that a further consideration of them is to be recommended."

"The schist zones of Pipestone Lake and Pine River offer promising fields of search for the parent source of iron."

"Clays and shales are in great abundance for all ordinary purposes, but the presence of fire clay has not been definitely settled. While local deposits of this material would prove of much importance, it is not an absolute essential to the development of the district, and other parts of Saskatchewan will be able to supply any deficiency along the line of refractories."

"With the possible exception of oil and gas, there is not one single material of as much importance in the eventual development of North Saskatchewan as coal. Even though precious metals may be found, they are of little value in the absence of fuel to refine and transport them. Thus one is safe in making the statement that the key to the entire situation is coal. There is evidence to support the statement that the main coal field lies to the south, southeast of Wapawekka Lake, with an extension westward to Bowtree river. It now remains for the drill to prove this."

"The presence of oil shale was noted in the Benton formation near the northeast corner of the Bear Mountains. A carbonaceous residue in the Dakota Sands is thought to have been derived from oil. There are favorable conditions present for the accumulation of oil, such as a suitable medium under an imprevious cover, and typical oil bearing formations."

"While deposits of the more valuable metals like gold, silver, copper, etc., were not located, it should be understood that a very small portion of the territory under survey, lay within the proper geological formations for such materials, though it can safely be said that the schist zones of Pipestone Lake and Pine River offer very favorable ground for search and study from a prospector's point of view."

YUKON TERRITORY NEWS.

Captain George Black, member-elect for Yukon Territory, reports great activity at the new silver-lead camp at Mayo. The Treadwell interests are sinking two shafts to a depth of 300 feet, and these are to be connected by four levels. The Yukon Gold Company has struck a new vein on Keno Hill, the ore from which assays from 300 to 500 ounces of silver per ton. A new strike has been made at Galena Hill, about a mile from Keno Hill, and 60 claims have been staked. About 600 men are employed at Keno Hill.

The discovery of ground running up to $15 per pan on Allgold creek has caused a small stampede from Dawson and adjoining creeks. Allgold creek is a tributary of Flat creek.

Word has been received at Dawson to the effect that the Dominion Government has removed the embargo against the exportation of ores from Yukon Territory.

COMPANY CONTRACTS TO EXTRACT CRUDE OIL FROM TAR SANDS.

The C. E. Dutcher Oil Extraction Company has entered into an agreement with the Alberta Exploration Company to commence the commercial extraction of crude oil from the tar sands occurring along the banks of the Athabaska river by July next. The extraction company has taken a 21-year lease of the exploration company's extensive holdings in the vicinity of Fort McMurray. The extraction company has been conducting experiments for some time, and the results are said to have been entirely satisfactory.

PERSONAL.

Dr. Harold S. Davis has resigned from his industrial fellowships at the Mellon Institute of Industrial Research of the University of Pittsburgh to accept a position on the research staff of the Arthur D. Little Co., Inc., Cambridge, Mass.

CARBON BLACK.*

A Review of Industrial Uses and the Possibility of Commencing Production in Canada

Carbon black is made from natural gas. The process is simple and consists in burning the natural gas and allowing the smoky flame to impinge on a cool surface which causes the deposition of finely divided carbon. This is the carbon black of commerce.

Unlike lampblack, which is gray, carbon black is a very fluffy velvety jet black material. Its properties are unique, being very light, absolutely free from grit, and miscible with oil. In its brilliance and intensity of color it is unsurpassed for the manufacture of printing ink, to which purpose approximately 35 per cent. of the total production of carbon black is applied. The desideratum for modern rotary printing presses is a very rapid drying ink, permitting operation at high speed; the ink must be freely flowing, possess great covering power, and make an instantaneous and easy impression. The ink from carbon black possesses all these qualities. The usual procedure in making printing ink consists in mixing carbon black with oil in the proportion of one pound of the former to eight pounds of the latter. Nine pounds of such ink will print 2,250 copies of a 16-page newspaper; this is equivalent to 90 copies of a 300-page octavo book. A consideration of the multiplicity of metropolitan dailies and their millions of circulation, and of the vast numbers of magazines, will give some idea of the service that carbon black renders in enlightening the reading public of this era.

Within recent years carbon black has, however, found another use of no less importance. For a long time manufacturers of rubber tires for automobiles, especially heavy motor trucks, have been searching for a substance that would increase the life of rubber by improving its wear-resistant power and increasing its resiliency. Such a reinforcing agent was eventually found in carbon black which actually increases the tensile strength and elasticity of motor tires 25 per cent. and 10 per cent. respectively. Manufacturers are thus enabled to give gorgeous display to advertisements, guaranteeing to tires a mileage of 6,000, 8,000, and even 10,000 miles.

In the automobile industry carbon black finds an additional use in providing a pigment for automobile tops and cushion coverings that is superior to any other in its effectiveness in withstanding the vagaries of the weather.

In many familiar products of every-day use, this fluffy black substance plays a part. To it leather goods owe their very fine, rich, black color, while for tinting purposes button manufacturers have no equal substitute. Stove and shoe polish manufacturers are unanimous in lauding its praises. To it is due the efficiency of the typewriter ribbons and carbon paper in modern offices, and, thanks to carbon black, the grating sounds from phonograph records need no longer disturb our equanimity.

Canada Dependent Upon Imoortations.

The United States is the chief producer of this extremely useful commodity, and in 1920 as many as 51,321,892 pounds were produced. Of this amount, 10 per cent. was used in the rubber industry, 35 per cent. in the production of printing inks, 10 per cent. for miscellaneous uses, and between 15 and 20 per cent. exported. Prior to the war the exports were approximately 33 per cent. of the production, but the increasing application of this material renders it very doubtful indeed whether the United States will be able to meet its own requirements in the year 1922. Accordingly, it behooves Canada, which has been solely dependent upon the United States for carbon black, to look to its own resources for the manufacture of this substance: for, in 1921, the total imports of blacks (comprising lamp, ivory bone and carbon) amounted to 3,494,416 pounds valued at $145,470, compared with 3,079,315 pounds, valued at $308,698 in 1920. The increase in 1921 was probably due largely to increased importations of carbon black.

Though it would be a great economic waste of a resource to use natural gas for the manufacture of carbon black in those localities where it can be used for domestic and industrial purposes, the tremendous supplies of natural gas, rich in hydro-carbons, that Canada possesses in the sparsely settled district of Alberta, would appear to suggest the feasibility of the establishment of a carbon black plant in the Dominion.

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*From office of Natural Resources Intelligence Branch, Department of the Interior, Ottawa, F. C. C. Lynch, Superintendent.

Chemical Society News

UNEXPECTED VISIT OF M. Ch. MOUREU, PRESIDENT INTERNATIONAL CHEMICAL UNION.

Although unknown to many of them, the chemists of Montreal were honored during the week of December 20th, by a visit from M. Ch. Moureu, President of the International Chemical Union, and Professor of the College de France, etc. M. Moureu had been hurriedly called by cable from France to attend the conference at Washington in reference to Chemical Warfare. At the earnest request of the University of Montreal, M. Moureu took advantage of two days' freedom to pay a fleeting visit to Montreal. Arriving on Tuesday, December 20th, 1921, he went to the University of Montreal, and later paid a visit to McGill University, where a short conference took place with Dr. Ruttan. Various points of interest were visited and a lecture given in the evening by M. Moureu on "Berthelot's Scientific Work," at the St. Sulpice Library. Notwithstanding the short notice, a large number were present testifying to the appreciation of the opportunity of hearing from one of the pre-eminent European scientists.

On Wednesday a very pleasant informal lunch was arranged by Dr. Baril at the club of the Montreal University. The chairman was M. Montpetit, Secretary of the University, M. Moureu being the guest of honor, with Mr. Harold J. Roast, by special invitation, representing the English speaking chemists. During the lunch one had opportunity of becoming acquainted with M. Moureu's attractive personality. As he spoke of the Great War, the indomitable Foch, the part that chemistry had played, his eyes flashed, the dark brows were raised, the high forehead knit, and then again the bright smile broke through as victory was the theme and once more the armies of La Belle France advanced.

There must have been something of necromancy to the citizen of Old France, who, having travelled over three thousand miles to the Western Hemisphere, found himself in the company of those who spoke not his language, and whose customs differed widely from those of his own land, came another few hundred miles north to find in the North Land those who spoke his tongue, whose customs and discourse were as that of his beloved France, to find himself surrounded by men who had studied his science at his own Alma Mater and with whom he could converse as with his fellow countrymen.

In these days of striving after international peace, surely such meetings are of the greatest value in preserving the "entente cordiale."

After lunch was over adjournment was made to the Chemical Lecture Theatre of the University where the Students and visitors were fortunate in hearing a "discours" by the savant on the production of acroline. Here again one could not but envy the fortunate students of La College de France privileged to absorb their Chemistry in so attractive a manner.

At the close of the lecture the degree of Doctor of Science was conferred on M. Moureu by the University amidst the universal applause of the gathering. Afterwards opportunity was given for the tendering to M. Moureu, on behalf of the English speaking chemists, their sincere good wishes and esteem.

The kindly thought of our French confreres in inviting a representative of the English chemists to share these ceremonies will not be forgotten.

Reported by Harold J. Roast, F.C.I.C., Secretary Canadian Institute of Chemistry.

NEW MEMBERS OF CANADIAN INSTITUTE OF CHEMISTRY.

The following have been accepted as members of the Canadian Institute of Chemistry:—

Fellows (F.C.I.C.)

Norman Ashwell Clark, B.S.A., M.A., Ph.D., Dept. of Chemistry Iowa State College, Ames, Iowa, U.S.A.

James Dick, F.I.C., c/o Mrs. Colson, 427 Mackay Street, Montreal.

Associates (A.C.I.C.)

David Wolochow, B.A., University of Saskatchewan, Saskatoon, Sask.

James Willard McKinney, B.Sc., M.Sc., McGill University, Montreal.

John Campbell Forbes, B.A., 628 University Drive, Saskatoon, Sask.

Carmen Milward Croft, B.Sc., 41 Lyon St., Ottawa, Ont.

Henri Charles P. Chaplean, B.A.Sc., Ch.E., 1571 Park Ave., Montreal.

Cyril Holesworth Crowe, B.Sc., 495 Princess Street, Kingston, Ont.

John Knox Affleck, B.A.Sc., 2 Spadina Road, Toronto, Ont.

Students.

Arnold Gillies Muirhead, 275 Albert Street, Kingston, Ont.

Wilfrid J. Grant, 83 Quebec Avenue, Toronto, Ont.

George Edwin Lewis, Camden East, Ont.

David Allan Cameron, Queens University, Kingston, Ont.

Charles Gordon Harford, 405 Quebec Ave., Toronto, Ont.

Allan Grey Hamilton, 230 Brock Street, Kingston, Ont.

NOMINATIONS FOR COUNCIL OF CANADIAN INSTITUTE OF CHEMISTRY.

Nomination for members of Council for vacancies occurring this year must be in the hands of the Secretary, Mr. H. J. Roast, 393 Guy St., Montreal, by February 20th.

Two vacancies occur in Ontario, one each in Quebec, New Brunswick and Saskatchewan. The elected representative from Quebec must, by the constitution, be, on this occasion, a Canadian of French extraction. A ballot will be mailed on or before April 4th. The period of election is for three years, and those retiring are: Prof. J. W. Bain, Dr. Harold E. Bigelow, Dr. Georges Baril, Dr. S. Basterfield and S. J. Cook. These gentlemen are not eligible for re-election until the lapse of one year.

OTTAWA SECTION, SOCIETY OF CHEMICAL INDUSTRY.

At the December meeting of the Ottawa Section of the Society of Chemical Industry, Dr. Alfred Tingle, Chief Chemist of the E. B. Eddy Company, addressed the members on the subject of "Paper Problems and Some Solutions." Emphasizing the great variety of material which can be used in the manufacture of paper, the speaker pointed out that cotton and linen rags now play a small part in this connection even among the first inventors of paper, the Chinese. Since any fibrous vegetable matter can be turned into paper if properly treated, the chemistry of paper making would leave no unity but for the fact that all these fibres are composed very largely of cellulose. Much of the science and art of paper making depends on so treating a particular class of fibre that it will do the work of some other fibre and do it better.

The chemical changes which take place during the manufacture of paper from sulphite pulp were dealt with in detail. Some are very obscure, because pure science has not yet caught up with technical practice. Several foreign universities are carrying on a close study of paper-makers' materials from the point of view of pure science. Advances are being made by paper chemists both in Canada and abroad. But there are many questions linking the discoveries of pure science with the work of the technologist which can be carried out neither in the universities nor the factories. It is here that Government institutions, such as the Forests Products Laboratory in Canada, should step in. Up to the present, the speaker said, the work done by the Canadian Government has only been in the way of routine survey work. He pointed out the necessity for the expansion of the study of this subject along the lines followed in the United States and elsewhere.

Thanks were voted to the Natural Resources Intelligence Branch for the preparation of the lantern slides used to illuminate the lecture.

Mr. Fred J. Hambly, Chairman of the Ottawa Section, presided at the meeting, and after the close of the speaker's address a number of the members took part in the discussion of the points raised.

An interesting feature of the evening was the presentation of short reviews by several of the members covering recent progress in industrial chemistry. The meeting was one of the regular series held by the Ottawa Section of the Society, at which papers of interest to the industrial chemical world are presented and discussed.

AMERICAN ELECTROCHEMICAL SOCIETY—SPRING MEETING, 1922.

The 41st meeeting of the American Electrochemical Society will be held in Baltimore, Md., April 27-29, 1922. This will be the first time that the Society has ever met in Baltimore. Three specially planned sessions will be held on Electric Furnace Cast Iron, Gases of the Electrochemical Industries, and Electromotive Chemistry. The many industrial plants located in the vicinity of Baltimore lend abundant opportunity for inspection trips.

TORONTO SECTION, SOCIETY OF CHEMICAL INDUSTRY.

The Toronto Section, Society of Chemical Industry, held a most successful meeting at Hart House, University of Toronto, Friday evening, January 27th. Over ninety members and guests sat down to the dinner that preceded the meeting, and the whole evening proved a most enjoyable and instructive event. Mr. M. L. Davies, Chairman, occupied the chair, and after the toast to the King had been honored, Mr. Davies referred to the presence of all the members of this year's graduating class in chemical engineering of the University of Toronto, some thirty odd, who were present as the guests of Mr. A. Neighorn, and the Chairman expressed the thanks of the Section to Mr. Neighorn for his generosity and thoughtfulness in inviting the students. A toast to the class of '22 chemical engineering was then given, to which Mr. Fair, President of the Industrial Chemical Club of the Univeristy, and Mr. Dingman, Secretary, responded. Mr. Fair said that a strong effort was being made to impress upon the students in chemical engineering the great value that the Society of Chemical Industry would be to them, and intimated that endeavors would be made shortly to have every member of the graduating class join the Society as Associates. Mr. Davies, on behalf of the Section, expressed the hope that as many students as possible would come into the Society. Needless to say, Mr. Fair's remarks were heartily approved by the gathering. The concluding toast was one that, unfortunately, the Society has never been able to give in Canada before, namely, to a member of the Society on his election to Parliament, and in proposing the toast to Mr. Joe Harris, M.P. for East York, Mr. Davies felt that the Society, the chemists, and the chemical industry in general had great need of a representative in parliament. Mr. Harris, in replying, said that he would at all times consider it a great pleasure to do whatever he could to advance the interests of the industrial chemists and of the industries they represented.

The meeting then adjourned to the lecture hall to hear the address of the evening, given by Mr. W. A. Schorman, superintendent refinery operations of the British American Oil Company, Toronto. Mr. Schorman's address was undoubtedly one of the best that has been given before the Toronto Section, and the large attendance was ample proof that the members knew that "something real good" would be given, for they remembered Mr. Schorman's excellent address of last year. Mr. Schorman's address was on "The Production of Gasoline," and bore particularly on the extraction of gasoline from natural gas and from destructive distillation or the cracking process. In spite of the fact that numerous patents had been taken out on cracking processes, Mr. Schorman urged the students present not to let these deter them, but that there was still a wide field for research, especially on the engineering angle of the problem. He also deplored the lack of legislation that would prevent the public from being duped by imposters who would make gasoline out of almost anything. Time and space does not permit further mention of Mr. Schorman's excellent address, but in our March issue the address will appear in full.

A splendid discussion followed, in which Dr. H. van der Linde, Professors Bain and Ardagh, Professor Harcourt, of the Ontario Agricultural Department, Mr. J. H. Mason and others took part. Mr. G C. McEwen and Mr. Eaton, of the Toronto Paint and Varnish Superintendents' Club, were invited to speak by the Chairman. Mr. McEwen told of the success the Club had met with and stated that in all probability every member of the Club would become an associate of the Society.

ANNUAL MEETING OF AMERICAN METRIC ASSOCIATION, TORONTO.

The Annual Meeting of the American Metric Association was held in Toronto on December 29, 1921.

Dr. George F. Kunz of New York, presided. The members were officially welcomed by Controller Russell Nesbit, of the Toronto Board of Control, and W. H. Alderson, President of the Toronto Board of Trade.

W. M. Crocker, who represents the American Metric Association in Washington, spoke on "The Legal Status of the Metric System and Pending Legislation." The Canadian members present were unanimous in the opinion that the passage of an effective metric bill by the United States congress would soon be followed by similar action in the Canadian parliament. The Association continues to present to congress, additional endorsments from national and state organizations of the Britten-Ladd metric bill now receiving the consideration of the Senate Manufacturers' Committee.

Professor Henry G. Bayer of New York University, concluded the morning session by speaking on "The Evolution of Metric Weights and Measures." He cited the speech of Talleyrand in April, 1790, on a "new system" of weights and measures, advocating "that other nations should be invited to make it international." Mr. Bayer showed that even then this desire for the advantages of international weights and measures was stirring in America. He quoted as follows from the message of George Washington to Congress on October 25, 1791: "A uniformity in the weights and measures of the country is among the important measures submitted to you by the Constitution; and, if it can be devised from a standard at once invariable and universal, must be no less honorable to the public councils than conducive to the public convenience."

Theodore H. Miller, Works Manager of the De Laval Separator Company, said in part, "About 1910 we changed to the general use of the metric system throughout our plant. The advantages gained by the use of so simple a system as the metric, have been worth to us, more than ten times the slight initial cost required to make the change. By placing on our drawings the expression, 'All dimensions in millimeters,' we follow the practice recommended by the American Metric Association, and avoid the necessity of placing even the familiar abbreviation 'mm' after figures."

A resolution was passed that a copy of the third edition of the booklet "Metric Weights and Measures" be sent to the leading industrial associations of Canada and the United States.

Chairman E. C. Bingham of the Committee on Local Sections has co-operated with the American Chemical Society and other organizations in having 300 of the universities and colleges order their chemical supplies in metric units. Manufacturers and dealers have been found very willing to fill orders in this manner.

Edward Richards and other members present from the Society of American Foresters, spoke on "The Application of the Metric System to Forestry."

W. W. Pearse of Toronto, well known as a construction engineer, spoke on co-operation in the metric campaign.

BOOK REVIEWS

"BLEACHING AND RELATED PROCESSES."

By J. Merritt Matthews, Chemical Catalog Co., Inc., New York. 676 pp. Price, $8.00 (U.S.A.).

Dr. Matthews is an outstanding writer and authority on applied textile chemistry in the United States. He has recorded from time to time the principal advances which have been made and, therefore, is in a good position to bring together related facts and descriptive processes on the general subject of bleaching.

In this work, the subject is treated in a very exhaustive manner, due balance being made between all classes of material which are bleached in any process of manufacture. The book is written by a textile chemist who is anxious to be understood by those in charge of actual mill operations, and for this reason full details of processes are given, without the same stress being placed on strictly theoretical considerations which might have been the case if the work had been designed from a different standpoint.

Some thirty-two chapters are set forth. Of these, seven relate to wool; two to silk; thirteen to cotton; and one to linen. The remaining chapters cover the bleaching of other vegetable materials. There are several very helpful chapters on the examination of materials used in bleaching. This portion of the work fits in extremely well with the general plan, and properly stresses an accurate knowledge of materials used and their proper testing and examination.

Machinery, both English and American, is well illustrated by some 300 drawings and photographs. The bleaching of cotton, being the most important material from an industrial viewpoint, receives very complete treatment. The scouring of wool is discussed at some length, and occasion is taken to dwell upon modern methods of water softening in this section.

There are probably many individuals whose textile experience has been long and specialized, who could make valuable additions to some chapters; but, as a contribution from one man on bleaching, the book is certainly a worthy effort. Those who are best able to confirm or disagree with the author's judgment will doubtless find the work most valuable.

In general, it is a standard book which can be heartily recommended to the whole textile trade, and all chemists interested in the textile industry.

"THE DETERMINATION OF HYDROGEN IONS."

By W. Mansfield Clark; 317 pp.; Williams & Wilkins Company. Price $5.25. (U.S.A.)

Few, if any, estimations of a quantitative nature find such a wide practical field in modern science. The development of good practice has called for a mass of research work which is still leading off in new directions. All chemists must be prepared to handle problems involving a full knowledge of what is being done, and for this reason students, teachers and chemists will find this outline of procedure a safe and practical guide in the making of ionic measurements. The theory of indicators is given in detail, and a full discussion of problems relating to choice of indicators, buffer solutions, etc.

A number of good drawings assist in demonstrating the arrangement of equipment, while charts give data in specific cases. One chart in particular shows the colors of eight different indicators at nine hydrogen-ion concentrations, covering in each case the change from alkaline to acid coloration.

The work can indeed be recommended, and will become a standard reference for chemists and biologists. The whole subject is covered in a complete way and supplemented by a fine bibliography.

"THE EMISSION OF ELECTRICITY FROM HOT BODIES."

By O. W. Richardson; Longman, Green & Co.; 320 pp. Price, $5.25.

This is a second edition of this book, appearing first in 1916. The book is devoted almost entirely to theoretical consideration, or at least fundamental scientific work.

Nine chapters, as follows, give the author's arrangements of the subject matter:

1. General Considerations.
2. Theory of the Emission of Electrons from Hot Bodies
3. Temperature Variation of Electron Emission.
4. The Effect of Gases on the Emission of Electrons.
5. Energetics of Electron Emission.
6. The Emission of Positive Ions by Hot Metals.
7. Effect of Gases on Liberation of Positive Ions.
8. The Emission of Ions by Heated Salts.
9. Ionization and Chemical Action.

The fundamental research work in this field is finding most important technical applications, and this book is an excellent summary of progress made.

"MODERN CHEMISTRY—PURE AND APPLIED."

Volume III.

By Arthur J. Hale; Virtue & Co., Ltd. 279 pp. Price, $4.50.

This is Volume Three of a new series, the first two volumes of which were reviewed a few months ago. This volume has sixteen page plates, covering industrial apparatus. The subject matter relates principally to carbon compounds and unites fundamental considerations with modern industrial practice in a most novel and rather delightful way. The selection of material for treatment forms a text which introduces the student to the general field, while the illustrations refer to organic processes which have a real existence in the industrial world. This conforms with the scope of the series, which might be defined as an attempt to combine the essential fundamentals of chemistry as a science with a survey of chemistry as it is applied to modern industries. We venture to think that the author has attained this end fairly well.

The series is one which could be placed in the hands of junior university or college students as something which would give them a very good introduction to the whole field and would be a nucleus around which they might begin to build up a library. The author's method of treatment, particularly from the viewpoint of industrial examples, is the feature of the book which will distinguish it from many others.

GOLD OUTPUT OF YUKON, 1921.

According to reports from Dawson, Y.T., the gold yield in the Yukon Valley, including the territory both in Canada and the United States, for the 1921 mining season, aggregated approximately $4,000,000.

OVERSEAS AND FOREIGN INDUSTRIAL NEWS

(Special Correspondence to Canadian Chemistry and Metallurgy, by Our London Representative.)

The Department of Scientific and Industrial Research in London has just published a Report of a General Discussion held jointly by the Faraday Society and the Physical Society of London on October 25th, 1920, on "The Physics and Chemistry of Colloids and Their Bearing on Industrial Questions" (H. M. Stationery Office, Kingsway, London, W.C.2. Price 2s. 6d.).

It is a book of 188 pages, containing treatises by a number of British and foreign research chemists, the various sections being as follows:—Section I: Emulsions and Emulsification; Section II.: The Physical Properties of Elastic Gels; Section III.: Glass and Pyrosols; Section IV.: Non-Aqueous Colloidal Systems; Section V.: Precipitation of Disperse Systems; Section VI.: Electric Endosmosis and Cataphoresis.

Progress in Establishing Dyestuff Industry.

The Dyestuffs Development Committee is making steady progress in its efforts to establish the dye-making industry on an efficient and economic basis, and is concentrating upon the improvement of the quality of dyes already made before tackling the question of new dyes. The manufacturers, at any rate, now know exactly in what particulars their dyes are failing to satisfy the consumers, and are continually encouraged to bring them up to the standard of production which the foreign dyes have reached Among the problems that have to be dealt with are the cost of some of the raw materials and the supply of intermediates of sufficient purity.

The Dyestuffs Advisory Licensing Committee has had before it during the first 10 months of the year over 3,000 applications for import licenses involving a total of something over 3,000,000 pounds of dyes, and applications for rather more than 60 per cent. of this quantity have been granted.

Home and foreign consumers of heavy chemicals are showing greater interest, and the volume of trade passing is more satisfactory than it has been of late.

Some Alloys of Aluminium.

The eleventh report to the Alloys Research Committee describes investigations into the properties of a large number of aluminium alloys. One section of the report deals with "cast alloys," for use both at ordinary and, more particularly, at high temperatures. Alloys of special interest from the latter point of view have been studied and developed. The value of certain forms of heat treatment, some of which include quenching from an elevated temperature, is particularly emphasized; in one instance the tensile strength of an alloy was increased from 13 tons per square inch to 21 tons per square inch by heat treatment. Alloys suitable for working by forging and rolling, extruding, stamping, pressing and spinning have also been investigated and developed.

By means of the experimental rolling mill at the National Physical Laboratory it has been possible to study such alloys on a large scale, under carefully regulated conditions. As a result of this study their manufacture on a commercial scale has been successfully carried out. Among the most important of these alloys is one containing 3 per cent. copper and 20 per cent. zinc (alloy "A"), which in the hot-rolled condition has a tensile strength of about 27 tons per square inch, with an elongation of 18 per cent.; another is a modification of alloy "A," containing about 0.5 per cent. of both manganese and magnesium, in which tensile strengths up to 40.7 tons per square inch have been obtained in rolled, heat treated samples. Another alloy (alloy "Y"), containing 4 per cent. of copper, 2 per cent. of nickel, and 1½ per cent. of magnesium, has, in the rolled, heat treated condition, a tensile strength of 26 tons per square inch with an elongation of 20 per cent.

Another section of the report deals with the permanence of the alloys in regard to strength, dimensions and liability to crack under prolonged loading. The last section describes investigation into the constitution of a number of aluminium alloy systems, including the copper-zinc-aluminium, magnesium-aluminium, silicon-aluminium systems. In the silicon-magnesium-aluminium series the age-hardening properties of the alloys have been definitely correlated with their constitution.

This official abstract of the report is issued by the Institution of Mechanical Engineers.

Stainless Iron.

Some firms who have been making stainless steel in Sheffield have taken in hand the development of the manufacture of the sister product, stainless iron, which is really a variety of stainless steel. At the present time stainless iron is at 1s. 6d. per pound in the bar and 2s. per pound in the sheet, making it very difficult to quote low prices for the finished article.

French Tar-Distilling Industry.

French tar production last year amounted approximately to 310,000 tons, 250,000 tons coming from the gasworks and the remainder from coke ovens. Yet, thanks to the increasing popularity of tar as a road-dressing material, 330,000 tons of tar and pitch were imported last year as compared with 280,000 tons in 1919.

It is evident that distillation is not making sufficient progress. Further, between 120,000 and 150,000 tons of finished products are arriving annually from abroad. Customs returns show that the import of oil, benzene, toluene, xylene, benzol, naphthaline, phenol, and other coal-tar products amounted to about 28,000 tons in 1919 and to 80,000 in 1920. That is to say, French industry was deprived by imports in the latter year of business represented by some 300,000,000f. worth of produce. In this is included 160,000,000f. worth of dyes.

This industry is comparatively new. The firms comprising it are only too keen to carry on, but their task is becoming almost impossible on account of foreign competition. Meanwhile the price of home-produced tar is maintained at a high level through the increased demand.

German and French Potash.

Under the Treaty of Versailles France fell heir to the rich potash deposits of Alsace, and those which belonged to German companies were provisionally taken over by the State. Their ultimate disposal still awaits the decision of Parliament, and meanwhile the Germans have been taking advantage of the uncertainty among their rivals to push the sales of the mines which remain in their hands, despite the fact that these are less rich in pure potash than the French. If sales in the German home market have sunk from 850,000 tons in 1918 to 690,000 in 1920, exports increased from 180,000 to 230,000. And now German potassium sulphate and chloride has begun to threaten the French market, so that the duty has had to be raised hurriedly from 3 to 30 francs per 100 kilos.

A somewhat similar illustration of French inability to exploit the advantages of their newly acquired territory is afforded by the case of the iron-ore mines of Briey, upon which Westphalian ironworks used to rely. By employing the Martin system for the treatment of non-phosphorous ore, instead of the Thomas system for phosphorous ore, the Germans have succeeded in freeing themselves to a very large extent from dependence on Lorraine, while French railway rates have made it as cheap to import from Sweden and Spain as from France. The net result is that French exports of iron ore to Germany have sunk to practically nothing, though in 1913 the Briey basin alone sent 976,000 tons into Westphalia and 489,000 to the Saar.

Indian Magnesite, Borax and Bauxite.

An important deposit of magnesite occurs at Salem in Madras. India has been a small exporter for some time and is in a position to supply all Eastern metallurgical developments.

India is becoming a large consumer of borax. Tibetan borax still competes with the imported.

Some good bauxite areas have been located in India and several plans have been proposed for the manufacture of aluminum. The Indian market for aluminum is still small, however.

Chemical Trade in British Malaya.

Chemicals figure fairly conspicuously among the imports into British Malaya. Red lead is received in considerable quantities for the ordinary uses of building and engineering trades, and a large amount of hematite is used for painting structural and other iron works, being usually imported in dry form, although it is also shipped ground in oil. Sulphur is imported in cases containing 112 one-pound packages, and is used on the rubber estates, in combination with arsenic, lime anl sugar, for killing white ants. Sulphurous acids, carbolic acid, and oxalic acid, are imported in small quantities for the dispensary trade About 5,000 demijohns of 44 lb. of glacial acetic acid are used in normal times every month in the coagulation of latex from the rubber trees. Citric acid is also used in considerable quantities in the manufacture of aerated waters, of which there is a large consumption. Among other products imported are turpentine (small but regular quantities); chloroform, which is sold under license: Paris green, which should not contain more than the stipulated margin of soluble arsenic-oxide, and lead arsenate, which last two are used by tobacco growers for the prevention of insect pests.

South African Asbestos.

Asbestos occurs over wide areas in the Transvaal, Cape Province and Rhodesia, and numerous fresh discoveries have been recorded during the past few months.

Nickel Ores in China.

Although up to the present very little has been done in China to produce nickel on a systematic basis, yet there is a strong probability that in the future this metal will be produced on quite a good scale. According to Finance and Commerce (Shanghai) it has been found so far in three regions. In Yunnan nickel ores consisting of glance, pyrites and kupfer-nickel, occurring in the gneiss, slate and quartz rocks of south-eastern Yunnan have been seen and sent to London for assay purposes, but no workings for this metal exist in the region. Certain galenas assayed from the Tungchwan region have been found to contain a small percentage of nickel. Associated with cobalt, the metal seems to exist in ores sent in for examination from the Red River district, to the west of Kochiu, but in none of these regions is any mining going on at the present time. Near Weining, in north-west Kweichow, ores containing nickel in conjunction with bismuth have been examined, and nickel has also been found in Shensi, but nothing is yet done on a systematic basis.

Japanese Rubber Manufactures.

During the war remarkable progress was made in the manufacture of rubber goods in Japan, and at the end of 1919 there existed no less than 320 large and small factories turning out all kinds of rubber goods, such as tires, tubes, belts, toys, etc., the value of the rubber ware produced in that year being estimated at over 30,000,000 yen. During last year, however, in consequence of the economic panic in the spring, many small factories in Osaka and Kobe were obliged to suspend work in the later months, and this resulted in an inevitable diminution of output, and the quantity of raw rubber consumed fell to 13,580,884 lb., valued at an equivalent figure in yen.

LIST OF FIRMS EXHIBITING IN THE CHEMICAL HALL, BRITISH INDUSTRIES FAIR, LONDON, FEB. 27-MARCH 10, 1922.

Heavy Chemicals, embracing the Alkali Industry, Disinfectants, Fertilizers, Insecticides, Tar and Ammonia Products, etc., etc. Some of the firms exhibiting these products are:—Acme Chemical Co., Ltd.; Albright & Wilson, Ltd.; Boake, Roberts & Co., Ltd.; Bowdler & Bickerdike; British Cyanides Co., Ltd.; Burt, Boulton & Haywood, Ltd.; Collett, J. M., & Co., Ltd.; Dennis, J. H. & Co., Ltd.; Gas Light & Coke Co.; Keelings Oxides, Ltd.; Laporte, B., Ltd.; Marley Hill Chemical Co., Ltd.; Midland Tar Distillers, Ltd.; Orrs Zinc White, Ltd.; St. Helens Smelting Co.; South Metropolitan Gas Co.; United Alkali Co., Ltd.; Wilkinson, J. B.; Wilson Bros. Bobbin Co., Ltd.

Dyes and Intermediates. Some of the firms exhibiting these products are:—Ajax Aniline Dye Manufacturing Co., Ltd.; Alliance Color & Chemical Co., Ltd.; British Alizarine Co., Ltd.; British Dyestuffs Corporation, Ltd.; Graesser-Monsanto Chemical Works, Ltd.; Grays Dyes & Colors, Ltd.; Hickson & Partners, Ltd.; Holliday, L. B., & Co., Ltd.; Leitch, J. W., & Co., Ltd.; North British Chemical Co. (England), Ltd.; Oxleys Dyes & Chemicals, Ltd.; Robinson, James & Co., Ltd.; Scottish Dyes, Ltd.; Sharp, J. B. & W. R., Ltd.; Southdown Chemical Co.; Williams Bros. & Co.

Fine Chemicals, embracing Analytical and Research Chemicals, Pharmaceutical Chemicals and Drugs Photographic Chemicals, etc. Some of the firms exhibiting these products are:—Allen (Fredk.) & Sons (Poplar), Ltd.; Allen (Stafford) & Sons, Ltd.; Boots Pure Drug Co., Ltd.; British Drug House, Ltd.; Burroughs Wellcome & Co.; Bush, W. J., & Co., Ltd.; Evans, Sons, Lescher & Webb, Ltd.;Hopkin & Williams, Ltd.; Howards & Sons, Ltd.; Johnson & Sons Manufacturing Chemists, Ltd.; Macfarlan, J. F., & Co.; May & Baker, Ltd.; Morson, Thos., & Son Ltd.; Pierson, Morell & Co., Ltd.; Rose, J. L.; Tyrer, Thos., & Co., Ltd.; Whiffen & Sons, Ltd.

Domestic Chemical Products, embracing Cleansing Preparations, Laundry Materials (Starch, Blue Bleaches, etc.), Medicines, Polishes, Soaps, Toilet Preparations and general Druggists' Sundries, etc. Some of the firms exhibiting these products are:—Cussons, Sons & Co., Ltd.; Dales, J. T.; Dubarry & Co.; Harker, Stagg & Morgan, Ltd.; Kiwi Polish Co., Pty., Ltd.; Knight, John, & Sons, Ltd.; Lovell, H. S., & Co.; Nugget Boot Polish Co.; Peace Pillow Co.; Redio Co., Ltd.; Sanagen Co., Ltd.; Sorbo Rubber Sponge Products, Ltd.; Stokes, Wm., Ltd.; Toogood, Wm., Ltd.; Watson, J., & Co., Ltd.; Ingram, J. G. & Son, Ltd.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy.)

B. C. MINERAL PRODUCTION DURING 1921.

With a view to cutting down expenses, it has been decided that no preliminary estimate of the mineral production of British Columbia is to be issued for 1921. Although no official figures will be available until next June, yet, as nearly all the copper has been produced by the Granby Company and all the lead and zinc by the Consolidated Company, it is possible to make a close estimate of the productions of these metals from the smelter returns. As much of the gold and silver is refined in the United States, the production of these two metals cannot be so closely approximated. The following figures, however, are offered in the belief that they will come as near to the actual production as a preliminary estimate can be expected to do. The production for 1920 is given for comparison:

Approximate Production for 1921.

	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Gold, oz.	131,128	$2,702,992	131,000	$2,687,000
Silver, oz.	3,377,849	3,235,980	2,800,000	1,751,400
Copper, lb.	44,887,676	7,832,899	30,000,000	3,759,000
Lead, lb.	39,208,268	2,826,115	45,000,000	1,939,500
Zinc, lb.	47,208,268	3,077,979	50,000,000	2,555,000
Coal, tons (2240 lb.)	2,595,125	12,957,625	2,080,000	10,400,000
Coke, tons (2240 lb.)	67,792	474,544	70,000	490,000
Miscellaneous	....	2,426,950	....	2,000,000
		$35,543,084		$25,581,900

According to the foregoing estimate, the mineral production of the Province for 1921 will show a decrease in value of 28 per cent., compared with the production for 1920, which, when it is remembered that British Columbia is essentially a base metal producing province and that, compared with the previous year, the average prices of base metals have decreased from 28 to 44 per cent., is really very creditable.

Gold Production Stationary.

Taking the metals individually, for some time it has been expected that the gold output would show a marked increase over that of 1920, owing to the much larger production of the Rossland mines. Work at the Nickel Plate mine, which was re-started in the fall, after twelve months of idleness at the mine, has been confined entirely to development. As the Nickel Plate mine in recent years has contributed about one-fifth of the gold output, its lack of production will about counterbalance the extra production from the Rossland mines. Owing to labor trouble, the completion of the tramway and concentrating and cyanide plants at the Premier mine have been delayed, and the mine started to produce steadily only during the last few weeks of the year, too late for the production to be counted in the year's returns. Consequently, as gold mining in other parts of the Province has been about the same as in 1920, the total production, also, should be very nearly the same.

Silver Production Decline.

The silver production will show a sharp decline in both quantity and value. This is due entirely to the fact that at the commencement of the year the Consolidated M. & S. Co. ceased to purchase ore, and consequently there was no market for the ores of the Slocan and Ainsworth districts which for the last quarter of a century have been the principal silver-lead districts of Canada. During the 27 years prior to the close of 1920 the average yearly output of these districts was 90,000 tons of ore, having a value of $1,200,000; in 1916, the most prosperous year for the districts, the output was 201,727 tons, valued at $4,510,593, while in the first ten months of 1921 the production was 2,773 tons, valued at $96,000. Added to this the Dolly Varden mine, which in 1920 produced 831,638 ounces of silver, was idle for practically the whole year, the Taylor Mining Co., which owns the mine, being unable to secure capital for a concentrating plant, without which, owing to transportation difficulties, the mine cannot be operated profitably. But for the few consignments of concentrate that have been made from the Premier mine, the silver production would have been very small.

Copper.

With the exception of a small production from the Rossland mines in the form of a by-product in the smelting of the gold ores, the Granby Consolidated M., S. & P. Co. has been the only company to produce copper during the year. Despite the slump in the price of copper, the Granby Company has run its plant close to capacity throughout the year. Metallurgical conditions have been vastly improved, wages have been reduced, and it is probable that the Granby has produced copper by pyritic smelting from ores containing less than 2.5 per cent. of copper at a price only slightly in advance of the price of the metal. As the company is storing large quantities of the metal, and as indications point to a steady rise in the price of copper, it would appear that the company has been justified in the course it has pursued. In any event it has been a great boon to the Province, as at its mines, smelter and colliery, it has given employment to some 1,500 men.

Lead and Zinc.

At one time it looked as though the lead and zinc production would show a marked increase compared with 1920, but the Consolidated company curtalled production at its Sullivan mine in October, and the individual operators had been too crippled to respond actively when the company entered the market again for custom ores. There will, however, be an appreciable gain in both lead and zinc production.

Coal Output Decreased.

The coal output will show a decrease in both quantity and value. This may be attributed to the fact that both the miners and the mine operators have failed to realize that the high wage-scale and the high prices of coal obtaining since the armistice cannot be maintained. The price of fuel oil in the coast cities has dropped from $5.50 per barrel at the beginning of the year to $2.50, and for transportation, industrial and domestic purposes, fuel oil is rapidly taking the place of coal in these centres, and will continue to do so as long as the present high prices of coal are maintained. A charge of $11 to $12 per ton for coal within 80 miles by water of the mines from which it is obtained is considered absurd.

The 1922 Outlook.

The outlook for the coming year I believe to be full of promise. By the time this review is published the new tramway at the Premier mine will be in operation, and the mine making regular shipments to the Tacoma smelter The Nickel Plate mine will be producing again in the Spring, and several new gold mines in the Sheep Creek district are likely to start to produce during the year The Britannia M. & S. Co. has appropriated one million dollars for the erection of a new concentrating plant, to replace the one destroyed by fire in February, and the crushing and pulverizing machinery has been ordered. The new plant, which should be finished during the year, will have a capacity of 2,500 tons of ore daily.

The Consolidated Company is looking around for copper ore to supply its plant. This company has smelting furnaces, refinery, and rod-mill capable of turning out 50 tons of copper rods daily, but has not ore to run the plant at one-tenth of its capacity. It is likely that either some arrangement will be made with the Canada Copper Corporation to operate its mine and concentrating plant, at Copper Mountain and Allenby, respectively, or the Voigt copper claims adjoining may be purchased. There is a large reserve of low-grade ore at both mines. The Sullivan mine at Kimberley is capable of providing the Consolidated company with sufficient ore to run its lead and zinc plants at capacity, and consequently the company is independent of custom ores.

Things do not appear so bright with regard to the Slocan and Ainsworth silver-lead-zinc districts and the coal-mining outlook. With regard to the latter, coal must be produced and sold at cheaper rates. To do this, wages will have to be reduced and coal-cutting and coal-loading machinery installed. The miners will raise strong objections to both, but unless firm means are taken the coal industry must collapse. The future of the industry rests with the miners and the operators. The difficulty in the Slocan and Ainsworth districts is not so easily settled. The confidence between the independent operators and the smelting company has been destroyed, and it is difficult to see how it can be restored. At the present time there is a duty of one per cent. per pound on lead imported into Canada. If some arrangement could be made by which the continued imposition of this duty were made conditional on the smelting company smelting as much custom ore as it smelted from its own mines, it would help the situation immensely.

From a mining and metallurgical standpoint the Consolidated Mining and Smelting Company has just completed the most successful year in its history, though, perhaps, as no dividends were declared, it hardly can be viewed in the same light from a financial standpoint. Still, that the company treated a greater tonnage of ore and produced a greater tonnage of metal in the face of a depressed metal market, when similar concerns were closing down completely in all directions, cannot be considered as other than a remarkable achievement. During the year the company received at its smelter at Trail 410,000 tons of ore, and produced metals to the estimated value of $6,694,865, compared with 383,112 tons and $7,326,925 in 1920. The following are the details of the production, those of 1920 being given for comparison:

	1920.	1921.
Gold, oz.	42,636	51,037
Silver, oz.	1,097,930	1,137,890
Copper, lb.	4,501,594	3,556,517
Lead, lb.	26,474,652	57,051,110
Zinc, lb.	36,995,390	51,131,270

With the exception of about 20,000 tons of ore that came from independent operators, 3,888 tons of which came from mines in the State of Washington, the whole of this large output was obtained from the Consolidated Company's own mines; the lead and zinc coming from the Sullivan mine at Kimberley and gold and copper from the War Eagle and Centre Star mines at Rossland. Part of the silver came from the Sullivan and part from the Rossland mines.

Improvements to Trail Smelter.

Several important improvements have been made at the Trail smelter during the year. The concentration of the Sullivan ore has been so improved that now it is no longer necessary to pick over the ore at the mine; the separation of the respective minerals being done entirely at the smelter. The Sullivan ore is a dense sulphide, containing blende, marmatite, galena, pyrite, and pyrrhotite, with about six per cent. of gangue. This is ground coarsely and tabled to separate part of the galena, and the tailing is pulverized finely and treated by selective flotation, resulting in high-grade lead and zinc concentrates. The method of roasting the zinc concentrate has been much improved, with the result that the formation of difficultly soluble ferrate of zinc is in the main avoided, consequently a greater proportion of the zinc goes into solution and a higher extraction of that metal is obtained. The residue, too, from the pachucas, being freer from zinc give less trouble in their subsequent treatment for lead and silver. The extension of the copper refinery has been completed, and now has a capacity of eight tons of copper or brass rods per eight-hour shift, has been finished. Little production, however, has been made from the copper department of the smelter, as the table of production shows. The improvements were made with a view to treating the product of the Canada Copper Corporation mine and plant, but these have been closed throughout the whole year, and consequently no feed for the copper smelter is available. In the meantime, the Consolidated Company is endeavoring to get the Federal Government to impose a duty on copper rods, which at the present time enter Canada duty free.

Among the improvements planned for the future, many of which are likely to be carried out during the present year, are the erection of the first 2,500-ton unit of the concentrating plant at the Sullivan mine—the present idea is that the final plant will have a capacity of 10,000 tons daily—and when the first unit is completed the plant at Trail now treating the Sullivan ore will be remodelled to treat the ore from the company's Rossland mines. The power plant, at Bonnington Falls, which is operated by a subsidiary company, the West Kootenay Power & Light Company, will be further developed to provide power for the new concentrator at Kimberley and more power for the smelter, which will be required when the capacity of the electrolytic zinc plant is increased. Some plan will have to be developed to provide feed for the copper department of the smelter. The Consolidated owns the Old Sport mine and has a controlling interest in the Sunloch mine both of which are situated on Vancouver Island, and a considerable tonnage of ore has been developed at both properties. Neither property as yet has a concentrating plant, and neither can be worked profitably without one. It is likely, therefore, that, unless arrangements can be made for the re-opening of the Canada Copper Corporation's mine and plant, concentrating plants will be erected at the Vancouver Island properties. The re-opening of the Canada Copper mine would be more satisfactory, as a large tonnage of ore has been developed and a thoroughly up-to-date plant has been erected, and undoubtedly a big effort will be made to effect this before the erection of plants on the Island properties are entertained.

Granby Co. Has Splendid Production.

The Granby company has followed closely on the heels of the Consolidated, and has made a splendid production. Details of the production are not yet to hand, but it has been stated unofficially that it will run in the neighborhood of 34,000,000 lb. of copper, 7,000 oz. of gold, and 300,000 oz. of silver. Improvements in metallurgical operations and a reduction in the wage-scale have resulted in a reduction of one and a half cents per pound in the cost of production of copper during the second half of last year, compared with the first half, and the company is now laying copper down in New York at a cost of 11 cents per pound. This figure does not take into consideration the interest on the company's bonded indebtedness of close to four million dollars, because this fund was raised for the purchase and equipment of the Cassidy colliery, and as the colliery is now producing and selling a large tonnage of coal beside that raised as fuel for the smelter, it is thought that the profits on the sales of coal should in future take care of the interest on the bonded indebtedness of the company. No plans for the future have been announced, but there is a strong rumor that a 2,500-ton concentrator is to be erected at the mines to treat a large body of ore of too low a grade for direct smelting. It is rumored, also, that the company will add a lead smelter to its plant, to take care of the Mayo district, in the Yukon, and the Stewart and Hazleton districts in British Columbia. Undoubtedly the time has arrived when a lead smelter on the British Columbia coast is needed.

Premier to Double Concentrating Plant.

The Premier Gold Mining Company put its new aerial tramway into operation at the close of the year, and it now is carrying ore and concentrate over the 11½ miles between the mine and the wharf at Stewart. Further improvements are contemplated at the mine, and it is likely that the capacity of the concentrating plant will be doubled during the present year. Details of the output of the mine for last year are not yet to hand, but it is known that it will approximate one million ounces of silver and 30 thousand ounces of gold. No attempt was made to push production last year, work being concentrated on development and construction.

New Mill in Operation at Silversmith.

The Silversmith Mines, Ltd., put its remodelled Invanhoe mill into operation on the last day of the year, and the plant gradually is being tuned up to its full capacity of 150 tons of ore per day. At the time of writing about 125 tons are being treated daily. The mill, which combines both gravity and flotation concentration, is being operated for three shifts per day and the mine for two shifts. A large quantity of ore has been developed. This mine, which formerly was called the Slocan Star, has produced more silver and lead than any other mine in British Columbia. Some years ago it was supposed that it was worked out, but last year large bodies of ore were developed below the old workings.

Granby Secures Large Coal Tract.

Two important appeals have been decided recently by the Privy Council, which vest the title to a large tract of coal land at Cassidy, Vancouver Island, securely with the Granby Consolidated Mining, Smelting & Power Company. These lands had been squatted on by settlers, and they, their heirs or assigns sold the land to the Granby Company. The Esquimalt & Nanaimo Railway, a subsidiary of the C. P. R., sought to have the Crown grants to these lands set aside, on the grounds that they formed part of the land grant deeded to the railway company by the Dominion Government in consideration for the construction of the railway. Originally there were four test cases, all of which were decided in favor of the railway company by the Supreme Court of British Columbia. The B. C. Court of Appeal reversed three of the cases and sustained one. One of the reversed cases and the sustained case were taken to the Privy Council, and both were given in favor of the Granby company. The decisions are doubly important, in that (1) the Granby company has developed and equipped a colliery and built a model village for its employees at a cost of more than $2,300,000; and (2) there are 173 applications on file for Crown grants in the same district, and these become automatically settled by the Privy Council decisions.

Britannia Mines Charged With Negligence.

The coroner's jury sitting on the bodies of those who lost their lives in the Britannia Beach disaster brought in a verdict accusing the Britannia Mining & Smelting Company, its manager and engineer with criminal negligence. As a result of this verdict, the Attorney-General has commenced action against the manager and engineer, charging criminal negligence in conection with the disaster, and Wilfred Dior, one of the miners who lost a wife and child in the disaster, has started an action for damages against the Britannia company.

Britannia to Rebuild Mill.

The Britannia M. & S. Co. will replace the wooden mill building, destroyed by fire last February, by a steel and concrete building, which it is estimated will cost in the neighborhood of $500,000, while the machinery will cost a like amount. The crushing machinery for the new plant has been ordered from the Taylor Engineering and Manufacturing Co., of Allentown, Pa. The new mill will have a capacity of 2,500 tons of ore per day, and will be the biggest copper ore concentrating plant in the Dominion, or, in fact, in the British Empire. The settlement that was destroyed by the recent disaster is to be replaced at once on higher ground, where there will be no possibility of such a disaster recurring.

Granby Co. Appeals Taxes.

The Granby Company has brought action in the Supreme Court of British Columbia against the Provincial Attorney-General, seeking a declaration with regard to its rights and liabilities under the British Columbia Taxation Act and a declaration to the effect that taxes for which it is liable were due until January 2, 1922, and will not be in arrears until December 31, 1922.

I. X. L. Mine Shipping to Sullivan Smelter.

A second consignment of bonanza ore has been shipped from the I. X. L. mine at Rossland to the Bunker Hill and Sullivan smelter at Kellogg, Idaho. The bonanza ore gave a return of 296 ounces of gold and 47.5 ounces of silver, the smelting company paying for the whole of the gold at $20 per ounce and for 95 per cent. of the silver. A charge of $8 per ton was made for treatment.

BRITISH COLUMBIA INDUSTRIAL NOTES.

The Union Oil Company, of California, has purchased a site just east of the Silver Foam Soap Company's plant at Esquimalt, Vancouver Island, and will erect a plant for the storage of the company's several products. The site is about two acres in extent, and the company will spend $35,000 on improvements.

The town of Saanich has awarded the contract for water extension pipe to Yarrows, Ltd., of Esquimalt. The value of the contract is $69,721.37, and the pipe is to be delivered at the rate of 100 tons monthly, until July 31 next. Yarrows will make the 12-inch pipe and purchase the smaller sizes from a British firm. Yarrows, Ltd., has only recently started the manufacture of water pipe.

The Alberta Colliery owners have been negotiating with the cities of Vancouver and Prince Rupert for the erection of large coal bunkers for the storage of Alberta coal at tide-water. The coal will be used for bunkering and other purposes. The entry of the Alberta coal mine operators into the British Columbia coast cities' market has caused a drop of $1 per ton in the price of Vancouver Island coal.

Hundreds of tons of supposed waste mined at the Coalmont collieries, in the Nicola Valley, has recently been found to be amber. Samples of the material sent to Ottawa and to New York have been pronounced to be amber of a good quality.

The Hon. John Oliver, Premier of British Columbia, and his two sons, Charles Edward Oliver and Joseph Oliver, have organized the Oliver Chemical Company, with a capital of $10,000, and laboratories in Vancouver. The company is to be a purely private concern. The business of the new company will be mainly in the nature of research, with a view to the utilization of by-products that at the present time are being wasted.

Recently the La Purisima, the Union Oil Company's big oil-tanker, delivered the first load of oil at the Union Oil Company of Canada's refinery, on Burrard Inlet, lately purchased from the B. C. Oil Refineries, Ltd. This marks the commencement of what is likely to be an extensive business that the Union Company purposes to develop. As business develops, the refinery will be enlarged and modernized. The Union Company supplies the C.P.R., which requires a large quantity of fuel oil at the present time, and is likely to require a great deal more in the future, as the new ocean liners that are to ply between Vancouver and the Orient will burn fuel oil, while those now in service are to be converted to oil-burners.

NORTHERN ONTARIO DEVELOPMENTS.

It is expected that the Tough-Oakes mine will be a large factor in the gold production from Kirkland Lake during 1922. Considerable improvements are being made to the mine and equipment.

The Hollinger company continues to develop satisfactorily. It is said that the executive may invest a large amount of the company's growing surplus in some subsidiary, probably a power development. Hollinger is developing five claims at Elbow Lake, Manitoba, where results are reported as excellent.

The financial condition of McIntyre is reported as very satisfactory, and its subsidiary, the Blue Diamond Coal Mine in Alberta, is also stated to be making favorable progress.

The Clifton-Porcupine Mines will probably resume operations at an early date, provided the necessary funds are forthcoming. The Clifton managers hope to get a small mill started a little later.

Prospects appear so favorable on the Lightning River claims that a gold rush is looked for in that vicinity. The promising ground, as reported, is not confined to the immediate vicinity of the Lightning Gold Claims, but is a wide area of nine miles, and of even greater length, extending from near the southwest shore of Upper Abitibi Lake to some distance south of the discovery claims.

In the Silver group, the McKinley-Darragh will reopen as soon as milder weather appears. Declines in costs are demanded by every silver mine executive, and at McKinley they hope to get the costs down to about 40 cents an ounce. The steady tone of the silver market is encouraging to the silver producers, but lower costs, especially lower freight rates, are required. The charges on ore to the smelters are a large item in the costs of any silver mine.

The Hollinger Consolidated Gold Mines, Limited, has commenced legal action for damages for an amount said to be $2,150,000. The sum, it is alleged, is damages caused by failure of the Northern Canada Power Company, Limited, and the Northern Canada Power Company to comply with a contract to supply the full needs of the mine during the winter months of 1920-21. The action has been pending for several months, examination for discovery having been made last fall.

That the finding of some selenium in ore from the Dome mine was not, as reported, the first appearance of selenium in the ores of Northern Ontario, is the contention of Mr. Frank H. Huff of the Teck-Hughes mine. Mr. Huff, in a letter to "The Northern Miner" (Cobalt), states that as early as 1915 he determined the mineral naumanite $(Ag_2 Pb) Se$ in ore from the Tough-Oakes. Mr. Huff also states that, during the past year, while doing research work on a refinery product at the Teck-Hughes he had always found it necessary to extract the selenium to obtain a quantative determination for tellurium.

NEW DEVELOPMENTS.

Match Factory.

It is reported that a new match factory will be established at Aurora, Ont., by independent interests.

New Talc Development.

The talc industry is being further developed by the operation of new deposits at Mines Centre, Ontario. Preparations are under way to operate a deposit of the lava variety.

Marble Quarries.

Canadian Marble Quarries Co., Ltd., are again opening up their workings at Bronson, Ont. Ontario marble deposits are as extensive and valuable as any on the continent.

Fertilizer Plant.

Scottish Fertilizers Co., of Welland, Ont., have completed their new plant which has a capacity of 200 tons per day.

Chemical Companies Secure New Factory.

Mr. Leo G. Ryan, President of the Mallinckrodt Chemical Works of Canada Ltd., and of the Wingate Chemical Co., announces the purchase of a new factory in Montreal, at a price well over $100,000. The new building is located in the heart of the wholesale district of Montreal at 468-482 St. Paul St. West, covering some 9,000 square feet of ground.

Developing Sodium Sulphate Deposit.—It is reported that a plant for developing the deposit of sodium sulphate at Stink Lake, Sask., is being erected by the Bishopric Chemical Company of Cincinnati.

"Testing That Pays Dividends."—This is the title of an interesting brochure gotten out by The Dorr Company, engineers, New York, descriptive of their research and testing laboratory at Westport, Conn. The Dorr Company have specialized for years in metallurgy, but have widened their operations to include many industries. The research laboratory at Westport is undoubtedly one of the best equipped on the continent.

NEW COLLEGIATE FOR THOROLD.

The ratepayers of the town of Thorold are to vote on a by-law for the expenditure of $60,000 for a new collegiate institute. The proposed plan is to make a large modern addition to the present High School building and the complete remodelling of the latter. The plans also call for a new chemical and physical laboratory.

SUMMARY OF CANADIAN TRADE, 1921.

The following summary of Canadian trade, imports and exports, has been prepared by the Dominion Bureau of Statistics, Ottawa. For purposes of comparison the amounts for 1919, 1920, and 1921 are given:—

IMPORTS AND EXPORTS BY MAIN GROUPS

	Twelve Months ended December 1919	1920	1921
Imports for Consumption—			
Vegetable Products	$201,176,439	$275,897,527	$199,072,474
Animal Products	77,758,931	77,687,752	43,793,277
Fibres and Textiles	181,476,656	301,127,914	129,294,178
Wood and Paper	39,795,480	58,716,331	38,239,672
Iron and its Products	182,908,337	255,445,012	127,470,117
Non-Ferrous Metals	45,646,202	61,159,298	31,469,401
Non-Ferrous Metals	15,646,202	61,459,298	31,469,401
Non-Metallic Minerals	117,844,215	191,885,040	153,017,057
Chemical Products	27,241,465	39,666,402	23,588,535
Other Commodities	64,165,888	74,735,742	53,449,887
Total Imports	$941,013,613	$1,336,921,021	$799,394,598
Dutiable Goods	$607,458,191	$890,847,353	$516,857,816
Free Goods	333,555,422	446,073 668	252 536,782
Duty Collected	$168,920,659	$203,028,802	$122,575,653
Exports (Canadian)—			
Vegetable Products	$399,757,680	$185,723,778	$357,728,877
Animal Products	323,702,832	220,783,180	141,335,176
Fibres and Textiles	29,101,207	27,209,768	7,875,525
Wood and Paper	193,300,496	291,812,295	186,092,991
Iron and its Products	90,276,721	84,504,821	32,620,942
Non-Ferrous Metals	56,829,541	55,539,880	27,214,004
Non-Metallic Minerals	30,138,482	11,380,883	25,034,872
Chemical Products	28,341,751	21,589,560	10,086,477
Other Commodities	89,546,896	16,112,977	14,710,956
Total Exports (Canadian	$1,240,995,606	$1,272,657,442	$802,699,820
Foreign Exports	53,834,766	30,147,672	13,994,461
Total Exports	$1,294,830,372	$1,302,805,114	$816,694,281

2—IMPORTS FROM AND EXPORTS TO UNITED KINGDOM AND UNITED STATES

Twelve Months ended December, 1921

Main Groups	Imports for Consumption From United Kingdom	From United States	Exports Canadian Produce To United Kingdom	To United States
Vegetable Products	$ 37,056,198	$ 93,093,820	$199,143,846	$ 74,007,872
Animal Products	2,310,465	34,788,541	75,477,800	19,018,072
Fibres and Textiles	45,974,684	62,893,320	1,023,385	3,432,644
Wood and Paper	2,752,714	33,766,024	16,488,789	149,801,738
Iron	9,787,562	116,369,721	5,016,082	4,815,819
Non-Ferrous Metals	2 751 444	26735 120	5,980,646	15,499,222
Non-Metallic Minerals	6,649,699	134,412,781	3,721,843	13,082,175
Chemical Products	3,095,776	17,229,587	856,003	7,191,748
Other Commodities	12,770,467	35,989,279	1,158,451	10,120,092
Totals	$123,149,009	$555,308.193	$308,866,848	$326,969,382

3—PRINCIPAL ARTICLES IMPORTED FOR CONSUMPTION

	Twelve Months ended December 1919	1920	1921
Animals, living	$ 2,519,654	$ 3,280,354	$ 2,578,435
Asphaltum and asphalt	447,348	642,366	557,798
Breadstuffs	19,266,167	27,629,259	14,191,627
Bricks, clays and tiles	2,501,407	4,034,324	2,348,202
Butter	573,007	629,727	1,718,305
Cheese	134,350	260,845	337,778
Chemicals	19,838,507	26,675,833	15,504,129
Coal—Anthracite	31,595,694	36,773,351	10,293,639
Bituminous	29,565,105	61,260,247	48,631,095
Cocoa and chocolate	5,879,591	5,116,128	3,137,364
Coffee	3,819,560	5,304,386	3.285,837
Cotton	71,517,742	124,336,700	66,877,103
Hides and Skins	18,298,645	16,128,997	4,724,457
Lard	930,452	3,182,240	1,496,893
Leather	15,274,592	13,408,731	6,605,182
Meats	20,169,881	10,795,957	10,777,142
Metals—Brass	4,442,460	6,337,775	3,493,272
Copper	6,996,765	10,642,159	3,824,767
Gold and Silver	585,926	1,152,453	709,083
Iron and Steel	150,500,893	213,316,321	102,467,745
Lead	757,268	2,589,380	262,280
Tin	10,604,503	15,395,518	5,997,773
Paints, Colours and Varnish	3,713,539	5,337,733	2,824,618
Paper	9,246,414	11,059,046	8,390,160
Petroleum—			
Crude Oil	19,830,924	28,633,905	23,815,805
Refined Oil	9,692,029	18,341,414	12,431,925
Pickles and Sauces	514,423	764,876	572,516
Rubber	13,529,333	19,937,289	7,638,062
Silk	26,401,916	38,513,597	20,623,339
Soap	1,258,157	1,698,515	1,219,726
Stone, Marble and Slate	2,842,884	1,851,814	3,195,950
Sugar and Molasses	65,500,259	84,653,330	59,205,565
Tea	6,166,852	11,261,863	8,170,486
Tobacco	13,656,233	15,718,180	10,589,745
Vegetables	5,377,081	6,265,907	4,575,486
Wood	20,582,585	31,244,982	17,387,967

In above Table 3 only those items of interest to chemists and metallurgists have been given from the report. It should be noted that in Table 3, "Chemicals" that is actual chemicals, drugs, etc., are given, whereas in Tables 1 and 2 "Chemical Products" include all chemical products such as dyestuffs, explosives, paints, etc.

4—PRINCIPAL ARTICLES OF CANADIAN PRODUCE EXPORTED

	Twelve Months ended December 1919	1920	1921
Hides and Skins	$18,889,928	$ 9,357,071	$ 3,665,660
Leather	14,917,203	11,609,051	4,560,905
Metals—			
Aluminium, bars, etc. . . . cwt.	145,763	197,163	53,998
	$4,455,031	$6,094,623	$1,259,703
Asbestos . . . ton	144,338	189,043	85,394
	$9,886,470	$11,887,456	$5,681,272
Brass, old and scrap . . . cwt.	96,569	34,398	19,967
	$1,275,448	$475,809	$126,832
Copper	14,680,434	15,877,306	7,455,794
Gold	5,037,123	4,642,909	2,550,524
Iron and Steel	65,616,701	62,240,099	23,087,016
Nickel . . . cwt.	413,556	601,993	127,591
	$8,126,344	$11,988,857	$3,102,944
Silver . . . oz.	15,405,161	11,834,504	13,166,827
	$16,410,797	$12,239,209	$8,199,663
Paper—Printing . . . cwt.	14,168,577	15,238,891	14,184,812
	$49,811,362	$72,920,225	$69,786,317
Other paper	10,171,907	13,823,785	5,724,628
Rubber	9,089,179	13,070,124	3,781,975
Textiles	19,491,407	15,095,437	5,721,651
Wood—			
Unmanufactured	93,215,547	123,512,727	73,565,900
Manufactured—			
Wood Pulp . . . cwt.	14,182,594	16,399,697	10,544,456
	$37,185,009	$76,383,978	$33,033,675
Other Mfd. Wood	2,995,004	4,337,806	3,141,960

STOCKS IN COLD STORAGE IN CANADA.

According to reports of the Dominion Bureau of Statistics, Ottawa, the amount of butter in storage, January 1, 1922, was 10,765,193 pounds of creamery, and 347,913 pounds of dairy, a decrease of over 20% in the amount of creamery and of over 50% in dairy butter, as compared with January 1, 1921. Oleomargarine stocks on January 1, 1922, were 214,465 pounds, a decrease of over 48% from January 1, 1921. Cheese in storage amounts to 15,421,353 pounds, an increase of over 39 over last year. Eggs in cold storage total 988,780 dozen, other than cold storage 255,509 dozen, and frozen 1,113,147 pounds on January 1, 1922.

RESEARCH GRADUATE ASSISTANTSHIPS.

To assist in the conduct of engineering research, the University of Illinois maintains fourteen Research Graduate Assistantships in the Engineering Experiment Station. These assistantships, for each of which there is allowed an annual stipend of $600 and freedom from all fees, except matriculation and diploma fees, are open to graduates of approved universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry. Fuller details may be secured from The Director, Engineering Experiment Station, University of Illinois, Urbana, Illinois. Applications must be presented by March 1st.

CATALOGUES RECEIVED.

The Bristol Company, Waterbury, Conn.—Catalogue No. 1501, just received from The Bristol Company, is descriptive of Bristol's Round Chart Recording Electrical Instruments, including Voltmeters, Ammeters, and Wattmeters. The latest development in Bristol's Recording Voltmeter and Ammeters is the elongated coil. This coil is composed of a solenoid and laminated alloy core, so proportioned that it permits the chart to be graduated according to the Law of Squares, which is considered an ideal chart. The great value of Bristol's Recording instruments to almost any industry is too well known to need further mention here they have proved their worth in hundreds of plants. The construction of all Bristol instruments is robust and simple, and they will continue in service for many years without adjustment or repairs.

Dr. G. W. Morden, Ph.D., a well-known Canadian chemist, has joined the science staff of the Collegiate Institute at London, Ont.

Chemical, Oil and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points.

GERMAN CHEMICAL PRICES, JANUARY QUOTATIONS.

(Specially written for Canadian Chemistry and Metallurgy by our Berlin Correspondent.)

Home and foreign consumers of industrial chemicals are showing greater reserve, at the opening of the new year, with reference to purchases, even if their stocks have somewhat diminished lately. The volume of trade passing through, therefore, is rather moderate, as speculators are cautious. For the time being, although manufacturers are still well occupied from the boom which recently took place, the economical situation on the whole is supposed to be rather unsatisfactory. The following quotations are given in marks per kilogram:

For those who are not familiar with the transfer of kilograms into pounds, the following relations hold:

1 kilogram=2.2046 pounds.

1 pound=0.4536 kilograms.

Acids. Acetic, 80% chemically pure, 8 marks per kilogram, domestic price; 17 mk. p. kg., export price; glacial 21 mk. p. kg. domestic, 19 mk. p. kg. export. Boracic, 49 mk. p. kg. domestic, 51 mk. p. kg. export. Oxalic, 98% to 100%, 42 mk. p. kg. domestic, 50 mk. p. kg. export. Sulphuric, 60 deg. Bé., 4.50 mk. p. kg. export, 66 deg. Bé., 6 mk. p. kg. export.

Alums. Powdered, 6.75 mk. p. kg. domestic, 8 mk. p. kg. export; lumps, 7.90 mk. p. kg. domestic, 9.10 mk. p. kg. export; Chrome-Alum, 15%, 19 mk. p. kg. domestic, 25 mk. p. kg. outside. Alumina Sulphate, 14% to 15%, 5 mk. p. kg. export. Ammoniac, Sal, crystallized, 22 mk. p. kg. domestic, 26 mk. p. kg. export; sublimed, 32 mk. p. kg. domestic. Ammonium Carbonate, powdered, 14 mk. p. kg. domestic, 16 mk. p. kg. export; lumps, 25 mk. p. kg. export. Barium Chloride, crystallized, 6.75 mk. p kg. domestic, 9.50 mk. p. kg. export. Bleaching Powder, 80%, 4.30 mk. p. kg. domestic, 5.10 mk. p. kg. export; 110% 8 mk. p. kg. export. Borax, crystallized, 23 mk. p. kg., powdered, 24 mk. p. kg. Calcium Chloride, 90% to 95%, 3.70 mk. p. kg. domestic, 4.35 mk. p. kg. export; 70% to 75%, 2.75 mk. p. kg. export. Copperas, green, 2.70 mk. p. kg. export. Copper Sulphate, 98% to 100%, 17 mk. p. kg. domestic, 19 mk. p kg. export. Epsom Salt, 3.50 mk. p. kg. export. Glauber's Salt, crystallized, 1.60 mk. p. kg. domestic, 2.70 mk. p. kg. export. Magnesium Chloride, fused, 4.50 mk. p. kg. export. Potash Carbonate, 96% to 98%, 21 mk. p. kg. domestic, 25 mk. p. kg. export; 90% to 95%, 19 mk. p. kg. domestic; 80% to 84%, 16 mk. p. kg. domestic. Potash Caustic, 88% to 92%, 24 mk. p. kg. domestic and 25.50 mk. p. kg. export. Potash Caustic Liquor, 50 deg., 13.50 mk. p. kg. domestic, 18 mk. p. kg. export. Potash Chlorate, 17 mk. p. kg domestic, 19 mk. p. kg. export. Potash Saltpetre, 15.75 mk. p. kg. domestic. Sal Ammoniac Spirit (0.910 sp. gr.), 8.30 mk. p. kg. export. Salt Cake, 96-98%, 3 mk. p. kg. domestic, 3.50 mk. p. kg. export. Soda Crystals, 2 mk. p. kg. domestic, 3.85 mk. p. kg. export. Soda Ash, 96-98%, 6 mk. p. kg. domestic, 17 mk. p. kg. export. Soda, Caustic, 125-128 deg., 29 mk. p. kg. domestic, 27 mk. p. kg. export. Soda Caustic, Liquor, 38-40 deg., 10 mk. p. kg. domestic. Soda Silicate, 30-40 deg. filtered, 1.75 mk. p. kg. domestic, 2.75 mk. p. kg. export. Sodium Bicarbonate (Ph. G. S. (B.P.) quality), 8.50 mk. p. kg. domestic, 9.75 mk. p kg. export. Soda Phosphate, double basic, 7 mk. p. kg. domestic, 7.75 mk. p. kg. export Soda Sulphide, 30-32 deg., 9 mk. p. kg. domestic, 10.25 mk. p. kg. export; 60-62 deg., 17 mk. p. kg. domestic, 19 mk. p. kg. export. Sulphur, powdered, 7 mk. p. kg. domestic. Zinc Chloride, 14 mk. p. kg. export. Zinc Oxide, 90-92%, 12 to 19 mk. p. kg. domestic.

Fine chemicals, and especially Pharmaceuticals, continue to attract attention, though the business is confined to comparatively small parcels for shipment outside this country. Quotations were (d=domestic price; e=export price):

Acetanilide, 65 mk. p. kg. d., 70 mk. p. kg. e. **Acids.** Acetyl-Salicylic, 1.80 mk. p. kg. d, 200 mk. p. kg. e. Benzoic, white sublimed, 45 mk. p. kg. d. Citric, 200 mk. p. kg. d., 220 mk. p. kg. e. Formic, 50%, 10.75 mk. p. kg. d., 85%, 16 mk. p. kg. d. Salicylic, 72 mk. p. kg. d., 76 mk. p. kg. e. Tartaric, crystallized, 76 to 80 mk. p. kg. d., 80 to 83 mk. p. kg. e., powdered, 77 to 80 mk. p. kg. d., 81 to 83 mk. p. kg. e. Antipyrine (lion and star brand), 360 mk. p. kg. d., 390 mk. p. kg. e. Aspirin powder, 400 mk. p. kg. d., 430 mk. p. kg. e.; tablets, in card-board rolls, 9.25 mk. each, d., 12 mk. each, e. Caffein, pure, 1100 mk. p. kg. d. Corrosive Sublimate, 160 mk. p. kg. d. Formaldehyde, 30%, 30 mk. p. kg. d., 45 mk. p. kg. e.; 40%, 45 mk. p. kg. d., 54 mk p. kg. e. Hexamethylenetetramine, 169 mk. p. kg. d. Hydroquinone, 177 mk. p. kg. d. Menthol, recrystallized, 2700 mk. p. kg. d. Phenacetin, 340 mk. p. kg. d., 360 mk. p. kg. e. Phenolphthalein, 160 mk. p. kg. d. Potash Permanganate, 51 mk. p. kg. d., 54 mk. p. kg. e. Potassium Bromide, crystallized, 40 mk. p. kg. d., 48 mk. p. kg. e. Potassium Cyanide, 70 mk. p. kg. d. Potassium Iodide, 1450 mk. p. kg. d., 1500 mk. p. kg. e. Potassium Sulfoguaiacolate, 250 mk. p. kg. d. Pyramidin, 1050 mk. p. kg. d., 1100 mk. p. kg. e. Quinine Hydrochloride, 5400 mk. p. kg. d., 6000 mk. p. kg. e. Resorcin, 300 mk. p. kg. d. Salol, 140 mk. p. kg. d., 160 mk. p. kg. e. Silver Nitrate, 2200 mk. p. kg. d. Soda Benzoate, 44 mk. p. kg. d. Sodium Cyanide, 60 mk. p. kg. d. Vanillin, chemically pure, 100%, 2900 mk. p. kg. d., 3050 mk. p. kg. e. Veronal, 750 mk. p. kg. d. Dyestuffs and paint materials met with a rather fair market, with fluctuating prices; quotations are: Blanc Fixe, paste form, 1.40 mk. p. kg. d., 1.60 mk. p. kg. e. Red Lead. 26 mk. p. kg. d., 29 mk. p. kg. e. White Lead, dry powdered, 29 mk. p. kg. d., 32 mk. p. kg. e.; white lead in oil, 24 mk. p. kg. d., 27 mk. p. kg. e. Sugar of Lead is worth 27 mk. p. kg. d., 28 mk. p. kg. e. Litharge, 24 mk. p kg. d., 26 mk. p. kg. e. Lithopone, Red Seal, 30%, 9.25 to 10.50 mk. p. kg. d., 14 to 15 mk. p. kg. e. Potassium Bichromate, 46 mk. p. kg. d., 52 mk. p. kg. e. Potash Prussiate, yellow, 65 mk. p. kg.; red, 110 mk. p. kg. Soda Hyposulphite, crystallized, 7 mk. p. kg. d., 9 mk. p. kg. e., pea-form, 11.50 mk. p. kg. e. Zinc, White, Red Seal, 19 to 20 mk. p. kg. d., 26 to 32 mk. p. kg. e.; Green Seal, 25 mk. p. kg. d., 36 mk. p. kg. e.

CHEMICALS.

February opens with business in general chemicals little improved from that at the beginning of the new year. There was a little spurt to the market during the second week in January, and while there has been no retrograde movement, yet the volume of business at the beginning of February is not, to any appreciable extent at least, larger than a month ago. But the encouraging aspect of the whole Canadian trade is the movement toward the stabilizing of prices. With the exception of one or two items, there has not been a single decline in prices during January, and February opens with a stability to quotations that is quite marked.

Heavy Chemicals.—The heavy chemical market, while not displaying any marked activity, is holding firm. The heavy acids, sulphuric, nitric, and muriatic remain firm in quotations, even though the volume of trade has not increased as much as was hoped. Bleaching powder, caustic soda and soda ash are practically stationary with new year quotations, and while a slight weakness was noticed in soda ash during the last week of January, no decline in price was effected. Dealers in soda ash are still getting from $2.90 to $3.00 per cwt., and none has been sold below the $2.90 quotation. Sodium bisulphite powder has dropped off to 7½c, but this is the only item that appears to have suffered a decline in the heavy chemicals. Color makers are finding yellow prussiate of soda very scarce, due to the fact that the German producers, after practically killing the English and American competition in it, were themselves unable to deliver the goods. Quotations in Montreal and Toronto on yellow prussiate of soda are at 18 to 18½c per lb., an increase of over 7 cents from October prices.

There is a good trade going in glycerine and quotations are holding steady.

C. P. Chemicals—A reduction in some of the C. P. chemicals was made on February 1st as follows: C. P. ammonia from 27 to 22 cents; hydrochloric acid from 16 to 14 cents; nitric acid from 24 to 22; sulphuric acid from 15 to 13 cents.

Fine Chemicals and Pharmaceuticals—Trading in pharmaceuticals is improving steadily and no startling reductions have occurred. There is a decided and steady movement towards stronger prices. Salicylic acid and aspirin are showing stronger tendencies, and the bromides are remaining firm.

A reduction in glacial acetic acid has occurred and quotations on carboys are .20½c per lb. and on barrels 20c f.o.b. Shawinigan Falls.

Oils, Coal Tar and Pitch—While crude creosote oil is still quoted at 40c per gal. by Toronto and Montreal dealers, an advance has been made during the month on the refined of 5 cents per gal. and is now quoted at 60c. Both the crude and refined coal tar have advanced one dollar per bbl. and coal tar pitch 25 cents per cwt.

Oils (Petroleum)—Both motor and lighting gasoline are holding steady in quotations, despite the fact that business in these commodities is not very heavy, and as with the spring months the trade in motor oils invariably picks up, any lower quotations need not be expected. (See quotation list, p. 42). Fuel oils are slightly easier. Mid-continent crude is steady at $2, but the Pennsylvania crude has dropped off to $3.25 from the January 1st quotation of $3.50.

Naval Stores—Turpentine has experienced a big advance and has jumped up 26 cents per gal. since January 1st. No change in quotations have occurred in rosins and the market is fairly quiet. Turpentine stocks are low and buyers who failed to take advantage of warnings and low prices during November and December will no doubt have cause for regret. Linseed oil has also advanced and business has considerably improved in linseed during the month, much better than was ever expected.

METALS.

Due to some extent to the lowering of exchange rates, copper quotations dropped off 50c per cwt. during January. In spite of the strenuous times through which the copper producers have come, distributing companies are facing the future optimistically and it is felt that the long expected revival in copper cannot be very much longer delayed.

With the exception of copper and zinc other metal quotations are holding steady. It will take another month or so before the steel industry will really know what to expect from construction trades, but present indications are that a very fair amount of construction work demanding steel will get under way this spring.

The nickel market remains dull, but business in monel metal has been decidedly encouraging to the International Nickel Co. There is no doubt but that the use of monel metal has won the hearty support of many engineers and it only remains for industry in general to return to more normal conditions for both the nickel and monel business to experience a forward move.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump and ground	100 Lbs.	4.75— 5.25
Ammonium Bromide	Lb.	.. — .42
Aluminium Sulphate, bags	100 Lbs.	.. — 2.50
Aluminium Sulphate, iron free	Cwt.	.. — 4.60
Ammonia, Aqua, 26, Carboys	Lb.	.. — .15
Ammonia, Aqua, 26, Drums	Lb.	.. —.09¼
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.30
Arsenic	Lb.	.. — .14
Barium Sulphate (Barytes)	Per Ton	30.00—35.00
Barium Chloride	Lb.	.04½— .06
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb.	.. — .26
Barium Sulphate, B.P.	Per Ton	100.00—110.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	100 Lbs.	.03¾—.04¼
Borax, crystals	Lb.	.07—.07½
Boric Acid, powdered	Lb.	.. —.15½
Bromine (technical)	Lb.	.. — .38
Calcium Carbide, car lots, f.o.b. works	Ton	.. —100.00
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —105.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	.. —110.00
Calcium Chloride, fused	Per Ton	38.00—40.00
Calcium Chloride, flake	Ton	.. —44.00
Caustic Soda, ground, drum	Cwt.	6.50— 6.75
Caustic Soda, solid, drum	Cwt.	5.75— 6.00
Camphor Monohromate	Lb.	.. — 3.00
Carbon Bisulphide, in drums	100 Lb.	.. — .12
Carbon tetrachloride, drums	Lb.	.19— 20
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, imported	Per Ton	30.00—35.00
Cobalt Oxide, black	Lb.	.. — 2.20
Cobalt Oxide, grey	Lb.	.. — 2.45
Copperas (Iron Sulphate) crystals	Lb.	.02¼—.02½
Copperas (Iron Sulphate) sugar	Lb.	.02¼—.02½
Copper Sulphate (Blue Vitriol)	Lb.	.07½—.08½
Corosive Sublimate (Mercuric Chloride)	Lb.	.. — .95
Fluorspar, ground	Tons	.. —30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.14— .15
Ferric Chloride, solution	Lb.	.. — .12
Hydrofluoric Acid, 60%	Lb.	.. — .30
Hydrofluoric Acid, 30%	Lb.	.. — .14
Hydrochloric Acid, carboys, 13	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	1.00— 1.10
Iodine, crude	Lb.	.. — 4.20
Iodine, resublimed	Lb.	.. — 5.00
Iron Oxide (red)	Lb.	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.15— .17
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.. — .10
Lithium Carbonate	Lb.	.. — 1.70
Lithopone	Lb.	.05½— .06
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl.	Lb.	.10— .12
Magnesium Sulphate	Lb.	.03— .04
Mag. Sulphate, B.P., Medicinal...Single	Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Muriatic Acid, 18	100 Lb.	2.75— 3.00
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt.	Lb.	.. —.16½
Nickel Salt, double, in bbl. lots	Lb.	.. — .15
Nickel Salt, double, per cwt.	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lb.	.09—.09¼
Phosphoric Acid, 85%	Lb.	.43— .50
Phosphoric Acid, 50%	Lb.	.29— .31
Phosphorus, yellow	Lb.	.. — .44
Potash Prussiate yellow	Lb.	.28— .30

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TABLE OF CONTENTS

Page

EDITORIALS:

- The Play's the Thing 52
- Give the Boys a Chance 52
- Synthetic Petroleum Research 53
- Action and Reaction 53

CORRESPONDENCE:

- Practical Suggestions on the Research Library Question 54

The Production of Gasoline. By W. A. P. Schorman 55

A Method of Detecting Bio-chemical Reactions in Various Fluids by Means of Aniline Dyes. By A. W. Hammond 58

Page

Generation of Steam by Electricity. By F. T. Kaelin 59

The Preparation of Anhydrous Formic Acid. By Maitland C. Boswell and H. E. Corman 63

Book Reviews 65

Chemical Society News 65

World Conditions and News in Chemical Fields 69

Mining and Metallurgy in British Columbia 71

Latest Chemical and Metallurgical Patents. By A. E. MacRae 72

Mineral Production in Ontario, 1921 73

Industrial News 74

Market Review 74

Buyers' Guide .... 43 Index to Advertisers... 52

FROM THE PUBLISHERS—

MAINTAINING YOUR VISION

History records some remarkable successes. In every walk of life, enthusiasm and vision have counted large as factors in securing the desired goal. Science has been the largest single element in the past two hundred years, and possibly before, in making visions facts.

The accumulated scientific equipment of the present day makes almost any vision, as far as material progress goes, a possibility. That manufacturer who wonders how the coming years will deal with him and his business should rely more on this trusty friend and aid to progress. How many manufacturers in Canada have turned to applied science to mend their losses in trade and make their products more valuable, in order that their markets shall remain secure?

If your business is to maintain a vision of the results possible around your plant, by the application of chemistry to industry, take heart. Industry may not recognize you or reward you as fully as you desire or think just; but the fact remains that the day must come and indeed has come, when your vision will be a reality.

There are some chemists who have never had a vision of their relationship in general to industry. What they have accomplished as individuals is small; but the progress due to men of their training as a class and men of science in general is the only progress we really have.

As an exercise, figure out the money value of the contributions chemists and scientists have made in the field you are in. The result will amaze you.

Your opportunity is positively greater than that of any of your predecessors. That is why you must not lose your vision.

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EDITORIALS

THE PLAY'S THE THING.

ONE of the greatest principles of all the great teachers, Confucius, Buddha, and, to the finest degree, Christ, was that of dealing with individuals and founding great movements on individual initiative and service. Are we not over-systematized? Many have experienced this sensation in a large city hospital and have come to the conclusion that patients are more or less in the way of being means rather than ends. The Board of Education in a large city, considering the relations of that board to organizations for co-operating with teachers and scholars, passed a resolution to control said bodies "in order to conserve the best interests of our school system," action to be taken, etc. No mention is made of the pupils.

The writer was present at a meeting of teachers which was addressed by a prominent speaker who urged them to use initiative. One of them was heard to say: "How long does he think we'd hold our jobs if we used any initiative?"

The trolley patron—or rather victim—has a vague idea that street cars run for public use, but is coming to realize the sad truth that he takes precedence after the system.

Public utilities must have system to cope with their problems, but is there not a sort of idolatry, especially with educational bodies, which tends to take the soul of service out of system and invest system per se with demiurgic powers?

If anything needs soul and sense it is the administration of education and public welfare.

CANADIAN DYES ON EXHIBITION.

AT the recent Textile Exhibition in Toronto one of the interesting spots was the little booth where Canadian dyes were shown. We have at least one real, honest-to-gracious dye making establishment in Canada.

The gentlemen in charge were kept busy answering questions. The favorite one was: "Can you make as good dyes as they do in Germany?" Another was: "Will these dyes stand the light as well as German dyes?"

The answers were that as dyes were the results of definite chemical reactions, it made little difference where they were made or who made them so long as the laws of chemical action were duly respected.

GIVE THE BOYS A CHANCE.

STUDENTS in chemistry at our Universities and Technical Schools have increased. There is a fear that employment for them will be hard to secure, particularly positions of the usual type.

Studentships at Universities are hardly a satisfactory answer, and the Research Council has yet to stimulate industries to do much for themselves.

From one standpoint, both our Universities and the Government are top-heavy with research ideas. Perhaps it is well that they are, but it is reasonably obvious to those who know industrial plants, that the first thing most of them need is not a research man, or a research staff, but a few, plain, ordinary young chemists, who will establish the first principles of scientific economy and control, and some type of laboratory. It is extremely foolish to talk to members of the Manufacturers' Association about research, combined or individual, before they have learned the usefulness of a chemist and a laboratory in their works. We should not be always pointing to the half-dozen examples in the United States, where large research staffs have been developed, but rather to the ordinary small plant where a chemist is employed.

Canadian industries could absorb young graduates much more quickly than they do, and should accept a larger responsibility in adapting them to their requirements.

Perhaps the best advice that can be given to young chemists at this time is to break new ground. Until more chemists are employed by our smaller firms and some of the largest, there is but little hope for industrial research. There are many manufacturers who feel that a chemist in their organization might be valuable, even if the chemical work done by him was small. Chemists should use any means available to secure their entrance to employment, and once this is attained they may use their knowledge of chemistry in the interests of the business and develop a laboratory. It is much easier to sell chemistry from the inside than the outside of any organization.

Our appeal to manufacturers is to give graduates in chemistry every opportunity in any field where they employ men able to do constructive thinking on their own initiative. The viewpoint of a chemist, trained as he is in the inter-relationships of materials and industries, is, or should be, extremely valuable to many manufacturers. In a period of keen competition, our industries need such guidance as much as they need business, and all individuals and agencies (whatever their ultimate aims may be), should urge our manufacturers to first of all erect the groundwork of chemical control and then develop the finer structure of research. Let us keep our general and special ideas on research in the national interest very much alive: but, at the same time, let us begin to use the men we have and need first. We require research, but most of all we need more application of researches already accomplished. Our word to all our readers is to "give the boys a chance."

SYNTHETIC PETROLEUM RESEARCH.

THE claim of Dr. Fischer, of the Wilhelm Institute, at Mulheim, that he has industrialized the laboratory researches of Berthelot and Sabatier and has produced petroleum synthetically on a commercial scale by the hydrogenation of coal tar in the presence of a nickel catalyst, may prove of the utmost importance to Western Canada, which, according to geologists, contains one-fifteenth of the known coal reserve of the world.

Whatever be the exact mechanism of the catalytic reaction, it is certain that Germany is showing great activity in industrial research, with a view to the synthetic production of petroleum, not only from coal tar, but also from coal gas, and in the latter form of research it is claimed some measure of success already has been achieved. The work, it is stated, already has passed from the purely scientific to the commercial stage, and large quantities of lignite are being distilled at the Burberck Works, at Halle, and at the Rositz Works, in Saxony.

In the meantime, we in Canada who have demonstrated that for ingenuity and skill our chemists are the equal of those in any other country, are continuing to burn coal in the old wasteful way, and are leaving our immense deposits of lignite and bituminous coal in western Canada comparatively undeveloped, while at the same time we are importing enormous quantities of crude oil, fuel oil, and motor fuel from our southern neighbors.

When are the governments of the Dominion, the several provinces, and the heads of our large manufacturing concerns going to realize that if Canada as a nation is to remain on the band-waggon of prosperity, it must give far more attention to industrial research in the future than it has done in the past?

Our investors and banks are as yet hardly educated up to the complexities of an industry based entirely on applied chemistry. Our most important single business is to bring educational forces to bear which will accomplish this desired change in the mental viewpoint of investors and manufacturers.

ACTION AND REACTION.

THE nurse was busy tidying up round the typhoid patient's bed. "What are you doing?" asked the patient. "Oh, just sweeping up a few crumbs." "Crumbs? If I had known there were any crumbs, I'd have got right out to find them." The chemist has been seeking for crumbs of comfort in the present outlook and is finding few. During the war we sought to cheer ourselves a little by saying that the great exactitude required in many cases to conform to rigid specifications, would lead to permanent appreciation of technical supervision. Alas, there came a time in the fevered demands of commerce immediately succeeding the armistice, when "Most anything you have, but send it quick" was the contrapuntal urge in all the orders of the day, and the works chemist saw his millennium postponed sine die. Depression followed. The commercial Pharoahs who thrived in the time of rush orders easily forgot the Josephs who helped them with close specifications, and coincident with shrinkage of trade, there was crepe on the laboratory door.

Business men are opening their eyes to a day of close competition. What will they do?

We know what they should do, but chances are they will spend more on their advertising and sales staffs and cut down on equipment. Some wails will go out for the Government to organize and equip a research laboratory. It will not occur to four-fifths of them that a Government research laboratory can only co-operate with control laboratories in the plants, and is about as much use to the advertising and sales staffs as a power house is to a peanut stand.

NATIONAL RESEARCH INSTITUTE NOT A FREE CUSTOM LABORATORY.

A PARAGRAPH from the despatch of an Ottawa correspondent to a morning daily contains a line which shows that he and probably many others do not have any idea what the functions of a research laboratory are. He speaks of the need for such work "particularly for the small manufacturer and farmer who is unable to provide the expenses of a laboratory." He is so interested in the idea of putting the private consulting laboratory out of business that he forgets his grammar.

The National Research Institute will not be for the purpose of saving $5.00 or $10.00 here and there for a man who is too close to spend it with his local analyst.

CORRESPONDENCE

PRACTICAL SUGGESTIONS ON THE RESEARCH LIBRARY QUESTION.

The Editor, Canadian Chemistry and Metallurgy:

Dear Sir:—I am in very hearty agreement with your editorial in the February issue on "Libraries for Research Workers," but, while it is desirable that the Dominion Government should do something, it is very probable that it would take a good while, and much effort on someone's part, before any definite action could be expected in that quarter.

Having, on several occasions, given some thought to this matter, I believe that the following suggestions may be of use in securing results which, at lesat, would do for a start; it would then be much easier to approach the Government with concrete proposals, and the ability to show results already accomplished would be of great value in inducing the Government to give assistance.

There must be, in every city, a considerable number of scientific and technical books and magazines, which, if only their location were known to research workers and technical men generally, would be of great service to them.

Take, for example, the case of Toronto, the following institutions possess libraries composed largely of works of the kind referred to:—

The Engineers' Club.
The Royal Canadian Institute.
The University of Toronto.
The Works Department of the City of Toronto.
The Hydro-Electric Power Commission of Ontario
The Toronto Hydro-Electric System.

I have no doubt others might be found which could be included in the list.

At present these libraries act altogether independently of each other, and I have reason to believe that their systems of cataloguing are all different from each other. So far as I can see there is no reason why, with a little co-operation, all these libraries should not, practically, be one, to the great advantage of all those interested in the class of books which they contain. All the books in each library could, at comparatively trifling expense, be classified and catalogued under one uniform system using a card "title" catalogue and a card "author" catalogue.

The Dewey Decimal System, which is used in the public libraries in Toronto, and, in fact, in most of the great libraries of the world, could be used for the classification; this would link up the small libraries referred to above with the Toronto Public Reference Library on College Street, and, if need be, with all the public libraries of tho province.

If this plan were worked out properly, as I believe it easily could be, the following would be some of its advantages:—

(a) Each individual technical library could keep a card catalogue of the books, etc., in all the others, so that a man consulting the list of books at any centre could ascertain whether any book he wanted were available in the city or not.

(b) A good deal of duplication in the purchase of books and periodicals, by individual libraries, might be avoided

(c) It would frequently happen that a book desired by any one library could be consulted at another before purchasing.

(d) The owners of each library would afford facilities for any accredited technical or scientific man to consult their books, on a proper request being made. The advantage of this would oftentimes be very great.

(e) The compilation of bibliographies of certain subjects would be possible and could readily be undertaken.

(f) The cost of a scheme such as that proposed would be very small and could be covered by a comparatively insignificant subscription from each institution or firm participating in it; even this would be offset to some extent by certain economies which each library could probably effect by taking advantage, whenever possible, of the facilities afforded by the otbers.

To work the scheme properly it would be necessary to have a trained librarian with headquarters in, say, the Royal Canadian institute or the Engineers' Club, who would advise and assist the librarians of the individual libraries in the classification of books and other literature whenever necessary, and whose duties would include the proper co-ordination of all the libraries in order to secure the best efficiency.

It is likely that quite a few private firms in Toronto possess small technical libraries of their own, and I have little doubt that, if properly approached, such firms would be very willing to co-operate in a scheme of this kind because it would be a boon to their own technical men and of much value to others.

Many scientists, engineers, chemists, etc., have certain books in their possession, which, while being of no particular value to themselves, would be very useful indeed if made available to those specially interested; no doubt the owners would, in most cases, be quite willing to donate such works to some central organization if it were felt that some advantage would thereby be gained by other men.

Having had a good deal to do with the building up of one technical library in Toronto, I feel that I can write with some knowledge of the very real advantages to be gained by the adoption of some such plan as that given above. This plan is quite feasible and, were a commencement made in Toronto, it would be practicable to extend it along similar lines to other cities in the Dominion, and this even without Government assistance, although in the case of Ontario, I believe the Public Libraries Department of the Provincial Government would give any assistance in its power to a properly organized movement.

Personally, I would be very glad to see something done in this matter and am quite willing to help in any way I can to bring about the adoption of some definite scheme.

The opinions of your readers, on this subject, would be welcomed by,

Yours faithfully,
A. S. L. BARNES,
190 University Ave., Toronto.

CANADIAN MANUFACTURERS VISIT WEST INDIES.

A party of representative Canadian manufacturers left on February 15th for an extended visit to points in the West Indies. Canada now has a preference on this market.

Among those taking in the trip are: Sir Alexander Bertram, A. R. Whittall, J. D. Johnson, G. F. Towers, Douglas Mutch, A. H. Stratton, Col. W. R. Leonard, R. H. Turner, G. Clifford McAvity, J. W Davidson, George L. Lippert, H. Pocock, S. L. Gunn, Col. A. Hatch, W. J. Aitchison, James Anderson, W. H. Shapley, W. V. Green, Col. H. S. Edmonds, J. D. Bradshaw, W. J. Bradshaw, C. H. Payne

These leading manufacturers may be counted on to expand business for Canada.

The Production of Gasoline*

Different Processes Discussed in the Light of Most Recent Developments.

By W. A. P. SCHORMAN

SOON after the discovery of petroleum in the Oil Creek Valley of Venango County, Pennsylvania, research work of a more or less crude nature was begun to discover means for making a safe and satisfactory burning oil. This led to the discovery that the fractionation of petroleum was possible by means of distillation, although at that time there was practically no demand for anything but the kerosene fractions, and this remained the case until the industry grew to such proportions that the wastefulness of the earlier practices was recognized and led, first, to the design and production of gasoline stoves, to gasoline lighting systems, and then to the internal combustion engine, which latter has grown to such proportions, requiring such tremendous quantities of motor fuel, that the whole system of hydro-carbon distillation has been almost entirely reversed; for, where formerly the refiner's energy was directed towards the production of as little gasoline and as much kerosene as possible, it is now the problem of the refiner to produce all the gasoline possible to supply the ever-increasing demand. It is not the intention to enter into the chemical side of this problem, but to treat it more from the refining and engineering viewpoint, and to first briefly consider the production of gasoline from crude petroleum.

Production of Gasoline from Crude Petroleum.

This is done by charging a quantity of the latter into a cylindrical still, usually about 1,000 barrels' capacity, applying heat to the same and driving off the resultant vapors through a vapor pipe into a condenser coil, from where the condensate is conveyed through a test box and pipe line to a receiving tank. Distillation begins when the oil in the still has reached a temperature of about 140° to 150° F., the resultant stream at the end of the condenser testing about 80° Bè. or .667 specific gravity. The temperature of the oil in the still is gradually raised, the stream at the end of the condenser becoming correspondingly heavier until it reaches about 50° Bè. or .778 specific gravity. The naptha thus produced is then deodorized either by sulphuric acid treatment or steam distillation, or both, according to the content of aromatic compounds, sulphur or carbon, depending very largely upon the nature of the crude petroleum from which it is distilled. Until a few years ago, and even to-day, the industry is confronted by the user of gasoline who insists upon a gasoline of a certain Bèaume gravity, but this erroneous idea as to designating its quality is being gradually, but surely, exploded, for the refiner pays less attention now to the gravity of the gasoline than he does to the distillation range, which latter is by far the more satisfactory method of judging its quality. This fact was also recognized by the engineers and chemists of the allied nations during the war where gasoline played such an important part, that all specifications now state a definite distillation range; this is, usually, for winter use, an initial boiling point of not over 140 and not less than 100 and an end point of not over 410° F. For summer use this is modified to a maximum of 160° F. initial maximum, and the U. S. Navy specifications allow an end point of 437° F., although there appears to be a difference of opinion on the part of automotive engineers as to the advisability of such a high end point, as it means that the motor must be operated at what is considered an injuriously high temperature in order to insure total consumption, otherwise the heavier fractions, those distilling off above 420° F., are condensed and gradually reach the crank case past the pistons, washing the lubrication off the walls of the cylinders on their way, and finally destroying the lubricant in the crank case. If the pistons are tight, then the remaining heavy portions are either driven off through the exhaust pipe as heavy smoky vapors or they are converted into fixed carbon through repeated heating and insufficient oxygen to produce combustion. To guard against such dangers some refiners produce two grades of gasoline, one having an end point not over 360° F. and the other an end point not exceeding 420° F., at least that is the practice in Canada, but owing to the U. S. Navy specifications allowing 437° F. end point, many, if not all, refiners in the United States now use that for standard specifications, and, sad as it may seem to relate, some unscrupulous jobbers "improve" this by adding a little kerosene and raising the end point to 450° and even 460° F.

The ever increasing demand for gasoline, which a few years ago reached the point beyond production from fractional distillation of petroleum, necessitated the production of light hydro-carbon fractions by some other means, and almost simultaneously two methods offered themselves and, strange as it may seem, both were to some extent the result of accident. This refers to the extraction of gasoline from natural gas and the production of gasoline by means of destructive distillation, commonly referred to as the cracking process.

Extraction of Gasoline from Natural Gas.

The extraction of gasoline from natural gas is done in two ways—one known as the compression system and the other the absorption system. Natural gas, it was discovered, contained a considerable quantity of the vapors of the liquid hydrocarbons, these being known as the pentanes, the hexanes, and the heptanes, which are carried along with the gas very much in the same manner as water is carried in the air. It was discovered, however, that by compressing the natural gas to pressure up to 300 lbs. per square inch, it was possible to liquify these vapors together with the butanes and propanes, although the latter almost entirely escaped through evaporation when the resultant gasoline was exposed to atmospheric temperatures and pressures.

The process usually followed is to compress the so-called wet gas to a moderate pressure of about 90 to 100 lbs., passing the same through a low-stage cooler to a high-stage compressor; from there the gas passes through water-cooled cooling coils, from where it is expanded through an expansion valve and finally led to an accumulator tank, where the liquid portions are trapped. The gasoline thus produced is extremely volatile, difficult to handle, and must now be properly weathered before it can be safely shipped in either tank car or steel drum containers. It is high in unsaturated hydro-carbons and entirely unfit for a motor fuel or other purposes for which gasoline is ordinarily used, until it is blended with so-called straight run gasoline produced by fractionating petroleum. In the absorption process the wet gas is passed through an absorbing oil, usually of the very heavy kerosene fractions, commonly called mineral seal oil, where the heptanes, hexanes, and pentanes are precipitated, and the gasoline fractions afterward distilled off through fractionation. This latter process naturally produces a much better product, sweeter in odor and much lower in unsaturated hydro-carbons and less volatile, and consequently safer for transportation. Either of these products may be blended with straight run gasoline in limited quantities, thereby improving the gasoline, especially for winter use, but great care must be used in the blending of the two lest stratification should result which leads to no end of trouble.

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*Address delivered before Toronto Section, Society of Chemical Industry, January 27th, 1922, by Mr. W. A. Schorman, Superintendent of Refining, British American Oil Co., Ltd., Toronto.

Then, too, some refiners and jobbers have yielded to the temptation of blending casinghead gasoline with heavy benzine and even kerosene, the product being of a fairly high gravity, but a very poor motor fuel, thus proving the fallacy of buying gasoline on gravity specifications, because while the initial boiling point of such mixture is usually satisfactory, its end point is frequently as high as 460° F. Then, too, a product containing a high percentage of casinghead gasoline is difficult to handle in pumps, because the light fractions contained therein boil almost instantly, when subjected to a vacuum, with the result that the pumps lift only gas or part gas and gasoline, so that a self measuring pump is turned into an "Annanias." Should, however, the initial and end points of such a mixture be satisfactory, there still remains the problem of excessive vapor tension, which can only be avoided through careful blending. The extraction of gasoline from natural gas has grown tremendously during the last ten years, for, beginning about 1904, in a small way, with a production of about four thousand gallons that year, and although little progress was made until 1909, it has grown to a point where the daily production is now nearly three million gallons. The average production is between 1½ and 2 gallons per thousand cubic feet of gas, being in some localities as high as 3½ gallons per thousand cubic feet. The attractive part of this industry is that it takes its raw material, takes out of it what it wants and hands the residue back to the seller very little the worse for wear, because its fuel value based on B.T.U. has depreciated less than 2 per cent.; in other words, it is possible to take a thousand feet of saturated natural gas worth six cents, take out of it sixteen to twenty cents worth of gasoline, and return a thousand feet of dry gas still worth six cents. For this reason there are now a great many small plants in operation in Pennsylvania and West Virginia, usually a group of small producers pooling together if they have about 100,000 cubic feet of gas available per day, the initial cost being comparatively low.

Production of Gasoline By Destructive Distillation.

Now as to the production of gasoline by means of destructive distillation. The cracking of hydro-carbons by heat is simply an instance of the general rule that organic compounds are decomposed by heat. During the earlier experiments, which were carried on at high temperatures up to 650° C. at atmospheric pressure, it was soon discovered that the resulting gasoline was very high in olefine contents, running as high as 40 per cent. Research work was then begun for the purpose of hydrogenating the olefines, and various kinds of catalysts were introduced in the retorts. Platinum or palladium was used, but, needless to state, they were not commercially successful, although the former gave most encouraging results. Passing the vapors at high temperature through a mass of scrap iron gave encouraging, although not really satisfactory, results. This idea of hydrogenation of olefines led to innumerable patents being taken out by different inventors, until there are now nearly as many patents issued on cracking processes as there are "fleas on a healthy pup." This promiscuous issuing of patents has resulted in but one thing, which is that there are few refiners who pay any attention to these patents at all; instead, they go ahead and carry on their own experimental work, and in some cases operate their own cracking processes, because if one were to read a half a dozen of these patents there could be but one conclusion, namely, "How do they differ one from the other?" Litigations have been plentiful as a result, the final decision usually being deferred, but for the last four years a case has been before the Supreme Court of the United States, the case of Dubbs versus Burton, and while these two are fighting it out, quite a number of the smaller fellows are "running away with the bacon," hoping that they will never need to bring it back. Needless to state, the promoter has also crept into the game and, although he has no commercial plant in operation, he sometimes owns a beautiful model, a certificate bearing a seal of some country and a blue ribbon, but apparently feeling that there is no use cracking oil as long as there is the public.

However, it was discovered during the period of research that high temperature in connection with high pressure reduced the percentage of olefines and this combination is now in use in commercial cracking plants. It may be noted here, however, that cracking heavy hydro-carbons at a temperature ranging from 500° to 1400° F. and at pressures of from one to 340 atmospheres, or any combination of these temperatures and pressures, is all covered by some patent or other in every country of the civilized world, so, if any engineer or chemist has an idea about cracking heavy hydro-carbons it would be quite safe to state, "Go to it, you haven't anything that hasn't been patented, but go ahead anyway, you might find something not yet covered, if you don't have an accident."

The Burton Process.

Time will not permit to enter into the various details of the processes now in use, but let me briefly consider a few of the apparently commercially successful ones now in actual operation. Foremost among these was the Burton process. I say "was" because the original Burton stills are being rapidly replaced by a more modern type which it was found were much safer to operate, although a number of accidents have happened to these, and it is extremely unfortunate that one or two of these were accompanied by fatalities to the workmen in charge.

The original Burton stills were cylindrical in shape, from five to six feet in diameter, and sixteen to twenty-four feet long. They were operated at temperatures from 900 to 1100 degrees Fahrenheit and pressures from 75 to 90 pounds per square inch. The entire system, both still and condenser, was kept under pressure, but the advisability of keeping the condenser under pressure has been questioned by subsequent experiments. It was found that there was little or no difference in the final result, although the claim was made that by keeping the condenser under pressure the resultant product would be lower in unsaturated hydro-carbons. In the original installations frequent fires and some explosions occurred. This was due to the deposition of carbon on the bottom plates of the still, causing overheating and subsequent fracturing of the plates. To overcome this difficulty so-called carbon pans were introduced, and placed on the inside of the stills from three to four inches above the bottom. These pans received most of the carbon deposit and in that manner protected the bottom from becoming overheated, but even this construction was not satisfactory, as many accidents occurred and some very disastrous fires resulted from further explosions.

The Burton stills which are now in operation are built more on the style of a water tube boiler. After passing the heavy hydrocarbons through the still, the resultant product, commonly known as synthetic crude, is fractionated in the ordinary way, separating the lighter from the heavier fractions. Originally these light fractions were marketed as motor fuel throughout the Central Western States. It was yellow in appearance and contained some of the aromatic compounds which could not be entirely removed and were very objectionable on account of their odor. It was soon discovered that the trade did not take to this product as well as anticipated, although it was sold at about three cents per gallon below the price of gasoline. Since then the users of the Burton process have succeeded in purifying and deodorizing the product to a greater extent, and it is now commercially successful, although not entirely satisfactory.

Description of Dubbs Process.

The Dubbs process consists of passing heavy hydrocarbons through a retort constructed of four inch extra heavy tubes placed in a furnace, the temperatures ranging from 800 to 900 degrees Fahrenheit. From these tubes the vapors are passed through a "U" tube to extra heavy ten inch expansion coils, wherein the temperature drops approximately 100 degrees. From these expansion coils the vapors pass through a series of aerial condensers and dephlegmators, from where the condensate drops back into the original cracking coil, the final light vapors passing through the water cooled condenser coil into a receiver, from where the resultant liquid is forced into a receiving tank. The entire system, from the cracking coil through the expansion coil, aerial and water cooled condensers, and receiving tank, is kept under pressure of from 130 to 145 pounds per square inch. Considerable carbon deposit is obtained in the ten inch expansion coil, requiring its removal in periods of from one week to ten days. This is easily accomplished by circulating cold oil through the coils for several hours, the carbon becoming slightly saturated with the oil and contracting sufficiently so that the entire mass may be easily pushed out of the ten inch expansion coils, as very little and in some cases not any at all adheres to the walls of the coils. The resultant product in physical properties is about the same as that produced by the Burton process, having about the same percentage of unsaturated hydrocarbons.

The Greenstreet and Adams Processes.

The Greenstreet process, as well as the Adams process, introduced steam into their tube retorts in conjunction with the heavy hydrocarbons to be cracked. It is claimed that rehydrogenation takes place, the result being that the final product contained a smaller percentage of unsaturated hydrocarbons and from which no aromatic compounds are produced, making it a more desirable product for commercial purposes. In the Greenstreet retort two inch extra heavy tubes are used, the temperatures at which cracking is done are from 940 to 1 000 degrees Fahrenheit, the pressures varying from 75 to 85 pounds. In the operation the carbon is blown out of the tubes in the retort from one to three times per day, depending upon the nature of the hydrocarbons that are being cracked, both steam and compressed air being used for this purpose. In this manner it is quite possible to operate continuously without an extensive accumulation of carbon for a period of from six to ten days. The resultant product from this process is fractionated in the usual way and in some cases the heavier fractions returned to the cracking furnace for further treatment.

In the Adams process smaller tubes are used and it is claimed that the deposition of carbon is prevented on account of the high velocity at which the vapors pass through the small tubes in the presence of steam.

The Rittman Process.

The Rittman process consists of a single vertical tube, from ten to sixteen inches in diameter, and from twelve to sixteen feet long. Unlike some of the other processes, where cracking may be accomplished in both the vapor and liquid phase, the Rittman process cracks only in the vapor phase. The heavier hydrocarbons are sprayed into the top of the tube retort and are subjected to the higher temperatures and pressures, approximately about the same as those used in the other processes, in their downward course towards the bottom of the tube. Heat is applied at different heights, so as to obtain, as much as possible, a uniform temperature for the entire range of the tube. In the original invention an internal scraping device was used with the idea of separating the inner walls of the retort from any carbon that might have accumulated. This was found more or less unsatisfactory and was finally abandoned.

The modern Rittman stills retain simply a single tube fitted with a so-called tar box at the bottom, where the tarry mixture is accumulated and blown out under pressure. In this process, too, it was found that it makes comparatively little or no difference whether the vapors, after passing through the retort, were kept under pressure through the condenser, or, whether the control valve was placed between the retort and condenser, and the condenser carried only at atmospheric pressure.

Safety in Research Work.

Considerable research work covering the cracking of heavy hydrocarbons into light fractions has been carried on at our own plant. The first and foremost object that was kept in mind by those carrying on this research work was the safety of the apparatus, so that there would be no danger to the men directly employed. To state that during the two years of our research work there was neither injury or fatality to workmen speaks well for the safety feature which was employed. It was found to be advisable to use a retort of the tube type and in our case two inch tubes were used, each coil in a separate chamber, so that a comparatively small volume of distillate was in the retort at any one time, and although a number of fractures occurred in these retort coils, the resultant fire was merely a puff of very short duration. The pressures were immediately released and in no case did we experience any fire of greater duration than eight minutes. Several facts were produced to our own satisfaction: foremost among these was the relation of time, temperature and pressure for distillates of certain characteristics. We, too, found no difference between condensing with and without pressure. One fact we did establish was that by breaking up the heavy hydrocarbons when cracking in the liquid phase by means of impact discs we were able to increase our yield of gasoline from five to fifteen per cent. above that when these discs were not in use. We also found in cracking in the vapor phase that the further breaking up of the vapors under pressure by either impact or sudden change of direction, caused by the introduction of a counter-current of superheated steam at right angles to the current of the vapors coming from the retort, that a considerable increase in the final yield could be obtained.

In conclusion the writer wishes to state that any process that endangers adjoining property or the life of the operators in charge should be avoided, and commercialism should be laid aside until the proper factor of safety is thoroughly assured. Human life is too precious to be sacrificed upon the altar of gold, and experimenters should keep this one feature constantly before them.

A METHOD OF DETECTING BIOCHEMICAL REACTIONS IN VARIOUS FLUIDS BY MEANS OF ANILINE DYES.

By E. W. Hammond.*

ANYONE who has attempted to detect with certainty the changes taking place in fluids, whether of a chemical or of a bacteriological nature, knows that the usual methods adopted are not entirely satisfactory. While working along the lines of milk analysis, the use of aniline dyes suggested a new method of ascertaining whether the odors and keeping qualities of milk were due to bacteria, products from their growth, or enzyme reactions. It has, therefore, been the aim of the writer to compare some of the enzyme reactions with the bacterial count and to determine if it was possible to obtain the information desired from the bacterial count by shorter and easier methods.

Catalase Test.

In the year 1901 Oscar Loew found an enzyme which had the property of separating Hydrogen Peroxide into water and oxygen. He called this enzyme catalase. Loew demonstrated by careful experimentation that many micro-organisms are producers of catalase; for example, the bacillus prodigiosus. He also found that catalase has the property of oxidizing many chemical compounds and that it is instantly destroyed at a temperature of from 172° F. to 175° F. by a solution of 1% NaOH or a 1% mineral acid solution.

The Reductase Test.

The reductase test gives a quick and approximate idea of the number of bacteria contained in milk. Milk contains a reducing property which is called reductase.

Bacteria found in milk when inoculated into sterile milk generate reductase. The reductase property in milk is destroyed when it is heated to a temperature between 68° C.-70° C. for one-half hour. Pasteurized or boiled milk may by the development of bacteria regain its reductase property. The fat and cream contain more reductase than does the skimmed milk. Reductase will reduce the dye known as methlyene blue.

When a sample of milk contains a small number of bacteria, it will have no great reducing property. Sterilized milk could become reactive by raw milk or by bacteria.

It was these changes occurring in samples of milk which suggested to me the aniline dye test and which in my hands has given most satisfactory results. The method is not only a positive test for milk, but can be used with the different sugars, proteids, peptones and also as a color test for differentiating the numerous forms of bacteria that are to be found in the ordinary market milk. The solutions used are equal quantities of two aniline dyes, to which I have given the name, dichrome (or two colored sol). The dye is prepared as follows: Methylene Blue, ½% solution; Neutral Red, ½% solution.

The dyes are dissolved in distilled water and then mixed in equal quantities. As only drops of solutions are used, it is preferable not to make up too large quantities at a time. Add to the medium to be tested in the proportion of 1-3 drops of mixed dyes in 10 cc. of fluid used.

Samples of milk should be kept at temperatures near 80° F. in cool weather, and in warm weather at 70° F. The reason for this change of temperature is the difference in germ content of summer and winter milk.

The reductase and catalistic properties are well marked in all proteids and peptones and not in carbohydrates, unless, as will be shown in some of the tests, that yeast is added to set up a reductase action. The colors produced typify the nature of solution under examination.

Results Obtained with 1-3 Drops of Mixed Dye Solution.

Milk Tests.

Raw milk will turn pink and then gradually turn a canary yellow. This takes place within an hour and the rapidity of action indicates the bacterial condition of the milk.

Pasteurized milk remains blue for 4-5 hours and takes twenty-four hours to turn yellow.

Sterilized milk remains blue for an indefinite period. Sometimes three days are required to notice any change of color.

Sugar Tests.

Five per cent. solutions of the sugars are used for experimental purposes. A small piece of yeast, about the size of a pea, is added to each 25 cc. of fluid under examination. The same amount of dye and the same temperatures are to be used in all of the tests, viz.: 70° F.-80° F. Sucrose, Glucose, Maltose and Lactose were the sugars examined.

Sucrose within one hour changes to a deep pink.

Glucose within one hour changes to a purplish blue.

Maltose within one hour changes to a purple and blue strata.

Lactose requires two hours for any change, after which the solutions undergo numerous color changes within twenty-four hours.

Saccharine was also tried, adopting the same treatment as with the sugars, and after twenty-four hours turned a pea-green color.

Proteids and Peptones.

Egg albumen gives an emerald green color. Dried egg albumen solution gives a cornflower blue.

Pepsin gives a violet color.

Peptones give bottle-green color, then brown and lastly yellow.

Indol is then found in the yellow solution.

Bacterial Differentiating Test.

Colors are produced by adding a drop or two of the dichrome to culture tube before sterilizing. If examined in the usual bacteriological method it will be noticed that the bacteria will take on numerous colors and species are easily recognized and isolated.

Further and more extensive investigations along these lines are being made and will be reported. It is hoped that others may be interested enough to engage in similar work. These methods, if applied to dairy work, seem to point to a ready and reliable means of testing and controlling a milk supply.

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*Bacteriologist to City Dairy Co., Toronto.

Generation of Steam by Electricity*

The Design and Use of Electric Steam Generators for Waste and Part Time Power. Various Sizes and Types as Developed Recently by Shawinigan Water and Power Company.

By F. T. KAELIN†

THE electric steam generator is the result of a condition which leaves available for a portion of the day or year an excess of power over and above that required for manufacturing purposes.

This paper illustrates the usefulness and limitations of such apparatus in supplementing or even replacing boiler plants. The electric steam generator is a means of saving waste and a handy and simple apparatus for the conservation of energy.

More than three hundred installations are known to exist in Italy, Switzerland, Sweden and France. These have been developed within the last ten years. In Canada and the United States, a small number of generators have been in use for a short time. Under prevailing conditions, where electricity is sold on a kilowatt hour basis, electric steam generators cannot compete with steam produced by fuel; but it is possible to conceive that at points distant from fuel supplies, or where fuel was costly and hydro power developments reasonably cheap, the electric steam generator might become a competitor of fuel. Its chief object, however, is to transform idle power into useful heat.

The usefulness of an electric steam generator comes about in two main ways:—

1. Power purchased in block and used only a portion of the time may be used for steam generation. The low costs of a steam generator compared with other electrical apparatus for converting electric energy into heat and the wiring and control apparatus necessary is much in favor of this equipment. Pulp and paper manufacturing plants use considerable power during six days of the week A recent investigation shows that the saving in coal made by using electric steam generators for fifty-two Sundays and on holidays would easily pay for the installation of the steam generator in less than one year.

2. The present condition of power-producing companies allows them to sell power at a cheaper rate during such times as no other market is available. At the same time, no power company could afford to generate power for this purpose alone, or in real competition with coal.

Although many of the installations made recently in Canada are temporary, they will be found permanently useful. Night power may be available by close co-operation, due to the fact that starting and stopping electric steam generators takes only a few minutes.

In the electric steam generator all electric energy is converted into heat energy, the electric current passes through a resistance either of metal or formed by the water to be evaporated. The whole process of conversion is therefore governed by ohmic law. 1 KWH. is equivalent to 3412 b.t.u., the total heat content of 1 lb. of steam at an absolute pressure of 150 lbs. per square inch is 1193 b.t.u. Assuming feed water temperature of 150° F. the total heat to be supplied will be $1193 - (150 - 32) = 1075$ b.t.u. 1 KWH. will therefore produce $\frac{3412}{1075} = 3.17$ lbs. of steam, no heat loss considered.

The efficiency of the electric steam generator is very high; the only losses are the radiation losses of the apparatus, and the heat losses represented by a certain amount of water discharged from the generator and which carries away a certain amount of accumulated impurities in the feed water. By proper lagging and regulation of this discharge water the losses become very small, and, depending on the size of the generator, may be from 1 to 4%—for larger sizes of generators the efficiency can be taken around 98%. On this basis 1 KWH. will produce 3.10 lbs. steam. An electric steam generator of 1,000 K.W. capacity is equal to a boiler of 100 horse-power.

Types of Generators.

Electric steam generators have been built during the last ten years in capacities up to 1,000 K.W., and only in the last two years sizes of 2,000 K.W. and more have made their appearance. Steam generators may be divided into two main and distinct classes:—

First—Generators in which the electric current passes through a combination of metallic resistors.

Second—Generators in which the water itself forms the electric resistance.

In the first case the metallic resistors in the form of wire and ribbon of some high resistance alloy may be mounted in tubes similar to those in fire tube boilers. The arrangement allows the use of alternating or direct current, as the heating elements do not come in direct contact with water. In all other cases where the resistors are in contact with water and the current passes partly through metallic resistors and partly through water. only alternating current can be used as direct current would decompose water into its elements, hydrogen and oxygen. Generators of the metallic resistor type are only suitable for low voltages up to about 500 volts, and are therefore not usually adaptable for very large outputs. The steam production is controlled by switching on and off of a number of parallel circuits and the combination of such circuits in parallel or series connection. To maintain a constant steam pressure requires, therefore, rather complicated and expensive electric control equipment. Generators of this type have been built of 1,500 K.W. capacity, being of the tubular type construction, about 20 feet long and 5 ft. 6 inches in diameter. The space occupied by this type of generator is comparatively large compared with the steam generating capacity.

In the second class of generators the electric current passes through steam-tight insulating bushings to a system of stationary electrodes partly submerged in water—the water to be evaporated serves as the electric resistance. This type of generator is known as the "Revel Generator." and has been in use principally in Italy, Switzerland and France for the last ten years, mostly in self-contained units up to about 700 K.W. For any considerable amount of electric power only a three-phase alternating current system may be considered as practical to-day. For small units and of voltages up to about 2,200 volts, the container itself forms the neutral point of the three-phase system and is grounded. For larger capacity generators, especially when the voltage is in excess of 2,200 volts up to 12,000 volts, it will be advisable to split up the generator into three single-phase units with three containers, each containing one electrode, the three containers forming again the neutral point and are metallically connected together and grounded. Owing to the comparatively high resistance of the water and the many possibilities of arranging the electrodes, it is possible to make use of comparatively high voltages such as are used in general distribution of power in industrial plants, and obviates the use of step-down transformers, the cost of which would be greater than the cost of the steam generator itself. In order to maintain a constant steam pressure the generation of the steam has to follow closely the demand of the steam, which means the electric power input has to be regulated to suit the steam demand. This is done by the variation of the electric resistance, either by changing the submersion of the electrodes or varying the specific resistance of the water by suitably adjusting the amount of water fed to the generator and by controlling the water discharged either continuously or at certain intervals, carrying with it the accumulated impurities in the water.

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*Abstract of paper read January 19, 1922, before the joint meeting of the Montreal Section of the Society of Chemical Industry, the Engineering Institute of Canada, and the Institute of Mining and Metallurgy.

†Chief Engineer, Shawinigan Water and Power Co., Montreal.

The outstanding advantages of the steam generator of the water resistance type compared with other types are its simplicity in construction, compactness, easy control, and its very low cost per kilowatt capacity, which is very often the determining factor, especially for temporary installations or where flat rate power is consumed to fatten the load factor of an industrial plant.

Water Resistance Type.

The balance of Dr. Kaelin's paper dealt only with generators of the water-resistance type. For a long time water has been used as a resistor of alternating current motors. In the latter case a salt is added to the water, as otherwise the resistance would be too high. The use of water itself as an electric resistor for the production of steam is quite obvious, though it requires a certain amount of investigation as to the suitability of different sources of water, the variations of the resistance of water at various temperatures and pressure and the practical limits in dimensioning the current path through water for various amounts of energy and voltages up to 12,000 volts. The resistance of chemically pure water is very high and of the order of an insulator; the resistance decreases with the contents of soluble salts—it is lower for spring water than river water. Condensate water, available in most cases where the electric steam generator is in use, is of a high resistance, but as it contains always from 20 per cent. to 40 per cent. make-up water drawn from the river or other sources, its conductivity is brought up again to quite a practical figure. In general, it can be said that any water satisfactory for ordinary boilers is also suitable for the electric steam generator. The resistance of water has a negative temperature co-efficient; that is, the resistance is decreasing as the temperature and the pressure rise. Considerable investigations and tests have been made by the writer to determine the relations of resistance and temperature for various kinds of water, and special apparatus has been built for this purpose for currents up to 10 amperes and 6,000 volts for tests under atmospheric pressure. Fig. 1 shows a set of curves giving the relation of temperature and resistance for raw water from the St. Maurice River and for condensate water with about 25 raw water from the same source. Using a logarithmic scale, the curves appear as straight lines, and for many other tests not shown on this diagram it was found that these lines were all very nearly parallel. This would indicate that the same general law applies to any kind of water. The curves have been verified above the 100° C. temperature by tests on steam generators under pressure. The curve as shown on diagram, Fig. 1, can be expressed mathematically as follows:—

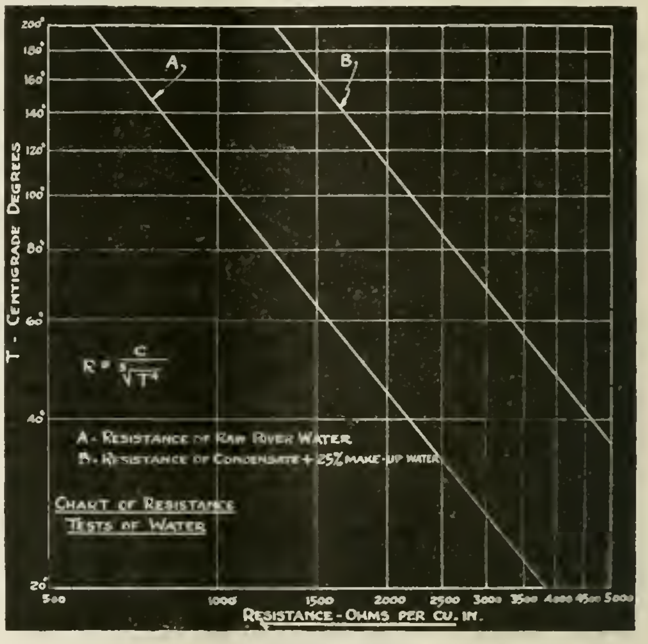

Fig. 1—Chart of Resistance Tests of Water.

$$R = \frac{C}{\sqrt[5]{T^4}}$$

R = Ohms per cubic inch.

C = a constant 42000 for curve A, 37000 for curve B.

T = temperature of water in centigrade.

In the early stages of the development of the steam generator it was thought that the investigation of the relation of temperature and resistance of different kinds of water would be of great importance, but it has been found later by experience in the operation of the steam generator that the resistance of the water in the steam generator could be controlled over a considerable range by discharging a certain amount of water from the generator. The purer the water and the higher the resistance the less water is to be discharged in order to maintain a suitable conductivity of the water.

Construction of Generator.

Fig. 2 shows a section of a 5,000-K.W. generator. It consists of a vertical cylindrical tank with an extension at the bottom. The upper part is flanged and to it is bolted a dished cover which contains three openings for the porcelain bushings insulating the three copper conductors leading to the electrodes. The insulator bushing consists of three parts, two corrugated sleeves, one of which is outside and the other inside the tank, and a tube inside these sleeves, which are held together by a shoulder and nut of the conductor passing through them. The faces of the sleeves are ground and are parallel, and are made steam-tight with the usual rubber steam packing. The packing also allows a certain adjustment for the difference in the expansion of porcelain and copper. The porcelain sleeves are subjected to considerable pressure and are made rather heavy for mechanical reasons and with electrical characteristics suitable for at least 6,600 volts working pressure between the phases. The conductors support through a system of adjustable links the steel electrodes of curved plates arranged in a circle equidistant from two cylinders, one outside and one inside, forming the central part of the 3-phase system, the outside fastened to the generator shell proper and the inside is suspended from the cover and well secured in a central position. Both these cylinders are electrically connected to the body of the generator and grounded. The arrangement shown in Fig. 2 is for 1,300 amperes, 2,200 volts, 3-phase, 60 cycles, and for a working pressure of 165 lbs. per square inch. The electric current passes through from both sides of the electrode to the inside and outside cylinders, and to much smaller amount directly from electrode to electrode. As the path of the electric current is not sharply defined, the ohmic resistance can only be calculated approximately.

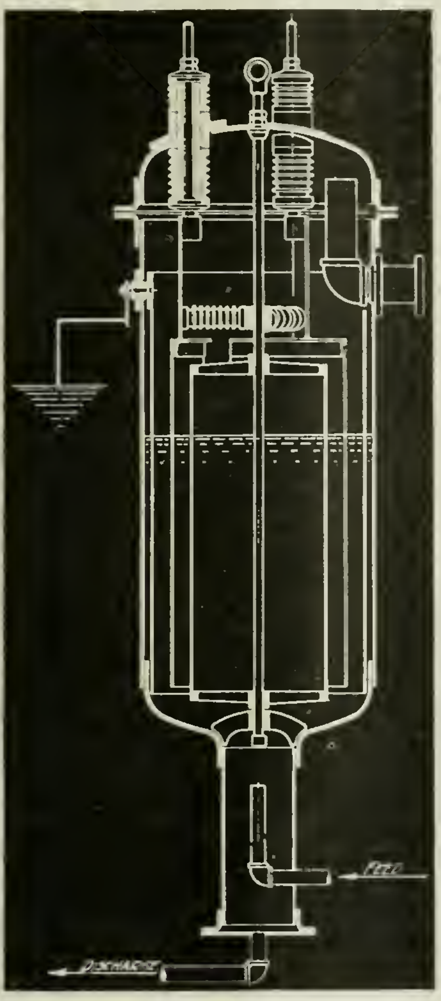

Fig. 2—Section of a 5,000 K.W. Generator.

Let R be the ohmic resistance between electrode and ground.

A = Total area of submerged part of electrode in sq. in.

d = Distance between electrode and ground in inches.

s = Resistance in ohms per cubic inch of water at normal operation of generator.

E = Voltage to neutral.

I = Current in amperes.

P = Electric power in K.W.

a = Current density = $\frac{I}{A}$

We have then $R = \frac{d}{A}$ $\quad s = \frac{E}{I}$ (1)

$A = \frac{I}{a}$ (2)

Substituting in equation No. 1 we will get

$E = d\ a\ s$ (3)

In equation No. 3 the right side contains three variables, the choosing of which is mainly a matter of experience and compromise to secure a satisfactory mechanical arrangement and safe operation. After d and a are chosen s is fixed—that means for a certain load and water level the specific resistance of the water has to be maintained by adjusting the relative amounts of inflowing and outflowing water. The outside shell of this 5,000-K.W. generator is 42" (107 cm.) diam. The length of the cylinder part is about 70", and is designed to stand a test pressure of 350 lbs. per sq. in. The lower end is provided with an inlet for the feed water and an outlet for the discharge and blow-off water. The generator is equipped with the customary water and pressure gauges and safety valves, and

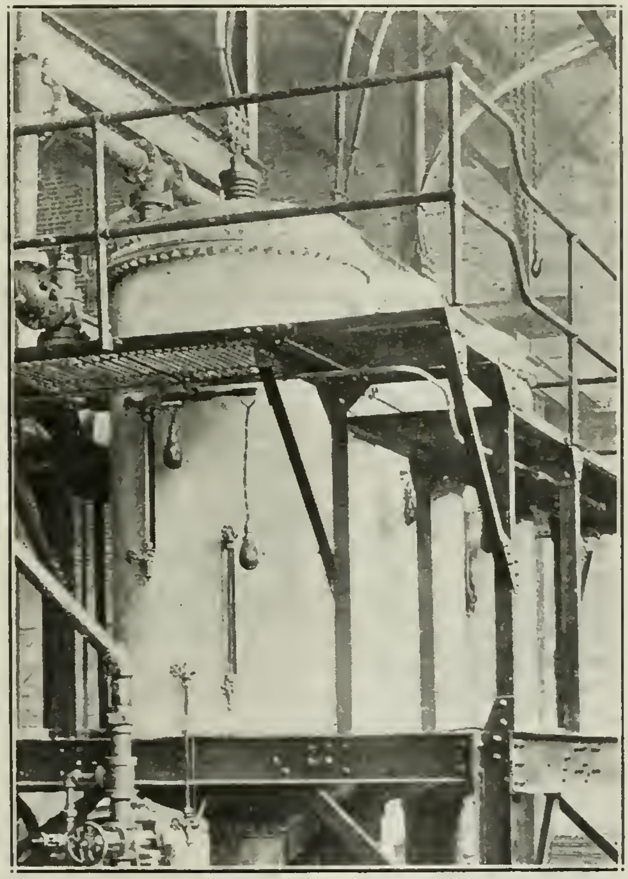

Fig. 3—Showing Installation of Three Tanks Forming One Generator Set.

the tank is mounted on a steel frame; for the larger generators with a gallery to give access to the top of the apparatus.

Three-Tank Unit.

An arrangement may be made of three tanks forming one steam generator unit, each tank containing one cylindrical electrode connected to one phase on the three-phase system. The tanks are connected on the steam side to a steam header, each tank having its separate inlet and bleeder for feed water. The three-tank arrangement affords a very simple mechanical design, and permits a more accurate calculation of the ohmic resistance of one phase to ground. The resistance of a body of water between two concentric cylinders may be integrated and expressed as follows:

$$R = \frac{s}{2 \pi h} \log c \frac{r_1}{r_2} = \frac{E}{1}$$

Where h means the height of the cylinder.
Where r_1 means the radius of outside cylinder
Where r_2 means the radius of inside cylinder.

From this equation the dimensions of this type of generator may be determined in a similar way as above for the three electrode arrangements in one tank.

In Fig. 3, the photograph, is shown an installation of such a three-tank unit. The general dimensions of the single tank are the same as above for the 5,000-K.W. single-tank unit. The voltage is 6,600 volts, the normal power input 18,000 K.W., with a maximum of 22,000 K.W., and at a working pressure of 135 lbs.—up to 60,000 lbs. of steam per hour are produced. The higher the steam production from a certain area of water surface, the wetter the steam produced. In the above shown installation a 10-inch standard steam separator keeps the moisture content of the steam down to 1½ %. Two similar generators of 25,000 K.W. each and one of 12,000 K.W. are at present in course of construction.

The floor space required by these types of generators is very small; the 5,000-K.W. generator, with electric control apparatus, can easily be placed in an area of 10 x 12 feet.

Operating Advantages.

The operation is extremely simple for the small generator, and where they are not working in parallel with other steam plants, the operation can be made automatic by means of a regulating valve actuated by the pressure and controlling the amount of discharge water, thereby changing the water level, which, in turn, governs the power input and steam production and at the same time keeps the steam pressure constant. For large units, and especially where they form only a smaller part of the existing steam plant, and are therefore not able to control the pressure alone, automatic regulation is not so simple, but the attention required is so small that one man could easily handle the operation of two to three very large units. For the electric control of the steam generator the usual apparatus such as disconnecting switches, oil switches, and preferably three ammeters, to show the balance in the three phase, are required. Power-measuring instruments may be added depending on the nature of the power contract and supply.

As the heat in the steam generator is produced in the water there are no parts subjected to a higher temperature than the temperature of the steam. This means that no dangerous stresses are produced by temperature differences, and this adds further to the safety of the apparatus.

There are other advantages of the electric steam generator over the usual coal-fired boiler, since any interruptions to feed water supply simply means the shutting down of the generator and does not introduce any danger. The steam generator is equipped with the usual steam safety valves, and can in addition be supplied with automatic blow-off valve, which discharges the water and thereby shutting down the generator should the pressure go beyond a fixed limit. Other safety devices consist in relay protection of the electric circuit in case of short circuit, unbalancing or ground on the electric system, and tripping the automatic oil switch, interrupt power, and therefore the steam supply. It can be seen therefore that the operation of the steam generator is just as safe, if not safer, than the ordinary boiler, and the Insurance Companies have no hesitation in accepting insurance on this apparatus in the usual manner.

THE PAST YEAR IN GERMANY.

Germany, from an industrial standpoint, is dangerous to other nations in two ways. If a breakdown occurs, which is not as likely as some imagine, no true trade stability is possible, until the repair is made. If she can continue to export below costs in other countries, she is a permanent danger to domestic industry. Her course is worth watching closely and the following indicates chief events during the twelve months of 1921:

January, 1921.—A decline in price, due to advance in German currency. Result—great optimism.

February.—A rest period with few market fluctuations.

March.—Taxes caused a slowing up of trade. The Leipzig Fair demonstrated that the day of substitutes was past.

April.—Further taxes and restraints on trade.

May.—Increase in railroad rates. Free trading in petroleum.

June.—Increase in drug prices.

July.—Further increase in taxes, with a large number of commercial failures.

August.—Increase in taxes. Depreciation of the Mark. Increase in buying of second quality goods.

September.—Great speculation in foreign funds. Failures increased. Wages increased in terms of Marks. Labor troubles noted.

October.—Loss of Upper Silesia.

November.—Great increase in prices, with scarcity of goods. Much buying from abroad. Duties go as high as 3900%. Moral tone of business dealings drops with growth of speculation fever.

December.—The "Reichskanzler" admits general position of Germany to be practically insolvent.

Since the beginning of the year no remarkable events have transpired. Some recovering of ground may have been made and adjusted; war debts have been met with fair satisfaction, everything considered.

It is almost inconceivable that the condition can become much worse during 1922. It should probably improve.

NEW GYPSUM DEVELOPMENT.

It is reported from Halifax that the Eastern Gypsum Co. have sold their property to the Great Bras d'Or Gypsum Co., Ltd., a new company representing American capital for the most part. The new company, according to the report, plan to spend $200,000 this summer in developing the property.

The Preparation of Anhydrous Formic Acid*

By MAITLAND C. BOSWELL AND H. E. CORMAN.

A RESEARCH which was undertaken in this laboratory required the use of a considerable quantity of anhydrous formic acid. An investigation of the literature and a few preliminary experiments having indicated that its production, even on a laboratory scale, is not a simple matter, we undertook the study of the conditions influencing the synthesis of a formic acid of as low water content as possible from sodium formate and sulphuric acid. This work having resulted in a method for the production of a formic acid of high concentration with fairly good yield, the endeavor was made to improve the methods now employed for converting this into anhydrous acid. Results were sufficiently satisfactory to warrant our believing that they might be of value not only to the increasing number of laboratory workers requiring anhydrous formic acid, but also to those engaged in its production on a larger scale. Although the experiments described below have all been carried out on the laboratory scale, yet simplicity of the various steps would seem to indicate the probability of a satisfactory application in large scale manufacture.

The chief commercial source of formic acid to-day is sodium formate, made by the action of carbon monoxide on sodium hydroxide, or by some modification of that reaction. The transformation of this salt by reaction with sulphuric acid into a formic acid of a concentration of only 90 per cent., with good yield, is not easy to accomplish, owing chiefly to the difficulty of preventing a partial decomposition of the formic acid by the sulphuric acid, even though the formate be taken in considerable excess over the amount required by the equation, while the production of a formic acid of 100 per cent. concentration from the salt has been carried out only by resorting to various devices for dehydrating the weaker acid. In order to carry out this latter step economically, according to any of the methods which, up to the present, have been devised, necessitates the employment of an acid of very high formic acid content, owing to the cost of the dehydrating agents, phosphorus, pentoxide and boron trioxide which are used for the purpose. Evidently the more nearly the formic acid obtainable for further concentration approaches 100 per cent., the less becomes the cost of carrying out the dehydration.

The objects of this investigation are (1) the study of the reaction of sodium formate and sulphuric acid with a view to improving the yield and increasing the concentration of formic acid obtainable from it, and (2) the endeavor to work out a process feasible on the manufacturing scale for transforming this high percentage acid into absolute formic acid.

The Reaction of Sodium Formate and Sulphuric Acid.

Meyer and Jacobson[1] and Thorpe[2] state that anhydrous formic acid can be made by the distillation of alkali formate salts with pure sulphuric acid according to the equation $2\ HCOONa + H_2SO_4 = 2\ HCOOH + Na_2SO_4$. On the contrary, a German patent[3] states that the use of highly concentrated mineral acids for obtaining formic acid from formates is undesirable, owing to their tendency to react with formic acid, but recommends the use of acid salts, instead of the acids, claiming that in this case the secondary reaction with formic acid does not occur, while the acid obtained is of a concentration 97 to 98 per cent. These two statements are evidently not in accord.

Several experiments were performed with 100 per cent. sulphuric acid and dry sodium formate. An excess of formate over the theoretical amount required by the above equation was used, as it was thought that this might avoid the presence of free sulphuric acid in the final distillation. The mixing was slowly carried out in a balloon flask provided with a return condenser, and immersed in cold water. The flask was well shaken in order to break up as much as possible the lumps which formed. After thorough mixing distillation was slowly carried out in an oil bath, care being taken to exclude moisture. No formic acid distilled over until the temperature of the bath had been maintained at 180° for a few minutes. On continued heating the contents of the flask balled together. Separate experiments in which a stirring apparatus was used still showed this balling together of material. The following results were obtained:

Results with 100% Sulphuric Acid and Dry Sodium Formate.

Sodium formate	68 g	186	151
Sodium formate in excess of theoretical	2 g	5	15
Sulphuric acid	49 g	130	98
Final temp. of bath	190°C	195	200
Theoretical yield	46 g	134	92
Yield obtained	13 g	46	25
Per cent. yield	25	32	24
Concentration of acid obtained	90%	90	88

It is thus seen that the best result obtainable under these conditions is a yield of about 30 per cent. of the theoretical formic acid at a concentration of about 90 per cent. acid. The low yield must be due to one or more of the following causes:

(1) The decomposition of formic acid by sulphuric acid.

(2) The reaction proceeding in two stages, viz.:

$$HCOONa + H_2SO_4 \rightleftarrows NaHSO_4 + HCOOH$$
$$NaHSO_4 + HCOONa \rightleftarrows Na_2SO_4 + HCOOH$$

with the consequent difficulty of securing intimate mixing of the two solids, the acid sulphate and the formate.

(3) The retention of formic acid by the solid mass.

It was found that a large amount of carbon monoxide was evolved in the reaction, indicating that a large loss of formic acid resulted by reaction with sulphuric acid. That the second of the above losses also occurs was shown by extracting a residue of the action of sodium formate and sulphuric acid with ether, carbon tetrachloride and chloroform. The extraction removed all the excess of sulphuric acid as well as the formic acid. On now allowing to stand the extracted residue produced more formic acid.

The Action of Sodium Acid Sulphate on Sodium Formate.

The use of sodium acid sulphate in place of sulphuric acid as described in the above mentioned patent was next studied. The two salts were thoroughly mixed in molecular proportions in a side necked distilling flask and slowly distilled by heating in an oil bath. In order to test the correctness of the patent claim that this procedure avoids the decomposition of formic acid which occurs when sulphuric acid is used, the apparatus was connected with a gas collector. Gas commenced to evolve when the temperature reached 185°C. Ten minutes later formic acid commenced to distil over. Heating was continued until no more liquid distilled over and gas evolution had ceased. The following results were obtained:

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*Contribution from the School of Engineering Research, University of Toronto.

Sodium acid sulphate taken	60 g	60 g	60 g
Sodium formate taken	34 g	34 g	34 g
Final temperature, deg. C.	185	190	195
Pressure	At.P	At.P	At.P
Theoretical yield of formic acid	23 g	23 g	23 g
Actual yield of formic acid	12.9g	8.4g	10.7g
Percentage yield	56.1	36.5	46.5
Concentration of acid per cent.	82.7	71.2	90.0
Carbon monoxide evolved	540 cc	2750 cc	1090 cc
Formic acid equivalent to carbon monoxide	1.1g	5.65g	2.24g
Per cent. of theoretical formic acid decomposed.	5	25	10

Thus the best yield obtained was 56% of the theoretical and this was in the form of 82 7% acid. The formic acid lost by decomposition varied from 5 to 25 per cent. of the theoretical yield. Thus it appears that, unless the reactions are carried out under some special conditions not described in the papers and patent above mentioned, absolute formic acid cannot be obtained by the reaction of sulphuric acid and sodium formate. Also, under the experimental conditions described above, and contrary to the patent, decomposition of formic acid does occur to a large extent when sulphuric acid is replaced by sodium acid sulphate in the reaction. Moreover, even though a 90% formic acid is obtainable by both methods, yet the yield is so low as to render the processes, in their present condition, of little use for carrying out even the first stage of the manufacture of absolute formic acid. It is true that percentage loss due to formic acid retained by the salts left in the still would likely be less in large scale manufacture than in production on a laboratory scale. However, the difference cou'd not possibly be sufficient to transform a yield of 50% into one economically satisfactory.

Distillations Under Low Pressure.

As the production of formic acid of concentration approaching 100% from acid of lower concentration by the methods of Schlesinger and Calvert[4], Schlesinger and Martin[5], Schlesinger and Reid[6], and Jones[7], was found to be much facilitated by carrying out the distillation under low pressure, it occurred to us that low pressure might be used to advantage in the production of the 90% acid from sodium formate and 100% sulphuric acid. The following experiments showed this to be true:

Sodium formate and 100% sulphuric acid in molecular proportions were thoroughly mixed in a balloon flask with cooling and care to avoid loss by evaporation and absorption of moisture, and allowed to stand seventeen hours. It was then distilled on a water bath at a pressure of 14 mm. mercury, the receiver being well cooled on ice, with care to avoid absorption of moisture, and loss by evaporation. The following results were obtained:

Dry sodium formate taken	136g	136g	136g	136g
Sulphuric acid taken	98	100	100	100
Calculated as H_2SO_4	100	103	106	120
Sulphuric acid in excess of theoretical	0	2	2	2
Pressure	20mm	16mm	17mm	18mm
Theoretical yield	92g	92g	92g	92g
Yield obtained	82g	82g	76g	69g
Per cent. yield	85	85	80	71
Concentration of formic acid per cent.	95	95	97.8	94

It will be seen at once that the process has been greatly improved by carrying out the reaction under low pressure. The best results were obtained when the sulphuric acid was between 100% and an acid containing 3% free sulphur trioxide. A sulphuric acid of higher trioxide content gave a formic acid of just as high concentration, but the yield decreased until at 20% free sulphur trioxide it had fallen by 15% of the theoretical. The high concentration of the formic acid obtained when a sulphuric acid of 6% free sulphur trioxide content was used may be connected with the fact that, in this experiment, the distillation was conducted rapidly, the temperature of the water bath being 60° C. instead of 35 to 40°, as in the other experiments of this group. In view of this it might be worth while to determine the effect of distilling at 60° in the case of 100% sulphuric acid where the percentage yield was considerably better.

An experiment similar in all respects to the first of this group, with the exception that the distillation was carried out immediately after mixing, gave a yield of only 38%, the acid obtained having a concentration of 95.5%. Thus the mixture should be allowed to stand in order that the reaction may run more nearly to completion before distillation is carried out. Although the percentage yield was much poorer, yet the concentration of acid obtained did not alter. Thus under the best conditions realized by us the yield of formic acid was raised from 35% to 85% and the concentration of acid from 90 to 95%.

As the percentage yields were found to be higher when acid sulphate was used instead of sulphuric acid, under atmospheric pressure, it was thought advisable to determine the yield obtainable in the former reaction under diminished pressure. Experiment showed that the mixture gave no formic acid until heated to a high temperature, while the yield was low.

The Dehydration of Formic Acid.

Schlesinger and Calvert[8] prepared an acid of 99.96 concentration by nine distillations of 95% acid with phosphorus pentoxide at a pressure of 35 mm. Shlesinger and Martin[9] prepared anhydrous formic acid by allowing boric acid anhydride to stand several days in contact with the weaker acid, followed by distillation under diminished pressure. Schlesinger and Reid[10] obtained their acid by distilling three times from one-tenth volume of phosphorus pentoxide at 20 to 27 and 10 to 18 mm. pressure. Jones[11] prepared anhydrous acid by the use of the theoretical amount of phosphorus pentoxide necessary to remove the water, and distillation under diminished pressure.

The removal of water from 100 lbs. of 95% formic acid would require in the above methods at least 13¼ lbs. of phosphorus pentoxide or 6½ lbs. of boric anhydride, provided the theoretical amounts of these would suffice, and provided no water were formed by the decomposition of formic acid. The cost of phosphorus pentoxide makes its use for this purpose prohibitive. Boric anhydride is cheaper and has the additional advantage that the oxide can be easily regenerated from the acid formed in the process.

In applying any of the above dehydration processes it is obviously desirable to have a formic acid of as high a concentration as possible. Successive "freezing out" and melting seemed to offer advantages, and the three following disconnected experiments show that this method might be used on a large scale successfully. An ice and common salt freezing mixture was used. The freezing was carried out in a flask provided with a one holed cork carrying a calcium chloride tube. The residual liquor was then quickly poured off and the calcium chloride tube again inserted:

(1) 250 grams 88% formic acid was frozen, yielding 100 grams of 95% acid as crystals.

(2) 250 grams 96% formic acid was frozen, yielding 100 grams of 99% acid as crystals.

(3) 250 grams 97% formic acid was frozen, yielding 235 grams of 99.6% acid.

A concentration higher than 99.6% was not obtained by repeating the melting and freezing of these crystals.

From these results it would appear that in the production of absolute formic acid the following procedure is advisable:

(1) Produce 95% formic acid from dry sodium formate and 100-103% sulphuric acid, distilling in a vacuum of 15 to 20 mm., according to the procedure described above.

(2) Raise this 95% acid to 99.6% by "freezing out."

(3) Make one distillation with boric anhydride, according to the method of Schlesinger and Martin.

SUMMARY.

(1) The conditions have been worked out for the production of 95% formic acid from sodium formate and sulphuric acid with a yield of 85% of the theoretical calculated from the formate used.

(2) In two freezings the formic acid may be raised from 95 to 99.6%, with a yield of about 44%.

Department of Chemical Engineering,
University of Toronto. Feb. 1st, 1922.

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BOOK REVIEWS

"QUALITATIVE ANALYSIS, INORGANIC SUBSTANCES; RARE ELEMENTS"

By H. Byers. D. Van Nostrand Co. 200 pages. Price $2.00.

The method of presentation used is to give a good introductory outline of methods of working. The author stresses a proper knowledge of solutions. Examination for acid radicals or ions is placed before metal analysis. This is followed by plans leading up to complete analysis. The rare elements are treated in five groups, and the author anticipates the time when in chemical courses for chemists at least this work will find a place in books for beginners. The word "rare" will hardly be suitable much longer for any but a few elements. Teachers and analytical chemists will find this work refreshing, well thought out, and balanced.

UNITED KINGDOM TRADE RETURNS, 1921.

The Trade and Navigation Returns of the United Kingdom for the month of December, 1921, and for the twelve months ended December 31st, speak for themselves very eloquently regarding the slump in business for which that year will long be remembered. Much of the decrease in the figures must of course be put down to the effects of reduced prices, but it is nevertheless important to note that imports during the year amounted to only £1,086,687,213, as compared with £1,932,648,881 for 1920, and 768,734,739 for 1913—the last complete pre-war year. Exports of British goods reached £703,196,282 in 1921, as against £1,334,469,269 in 1920, and £525,253,595 in 1913, in spite of the well-known fact that the heavy realization of foreign investments during the war renders export trade more than ever necessary in order to balance imports of food and raw materials of industry.

Chemical Society News

THE MANITOBA CHEMICAL SOCIETY—REPORTS OF RECENT MEETINGS.

The October and November meetings of the Manitoba Chemical Society were devoted to the election of officers, the discussion of the proposed amalgamation with the Canadian Institute of Chemistry, and the transaction of general business.

Mr. A. W. Alcock and Prof. W. F. Geddes were re-elected as Secretary and Treasurer respectively, while Prof. M. A. Parker, Dr. J. W. Shipley and Messrs. E. L. C. Forster and F. Pugh were appointed members of the executive committee.

The Society decided to again give a scholarship of $50 in matriculation chemistry in order to encourage the teaching and study of chemistry in the secondary schools of the Province.

The plans which had been put forward whereby amalgamation of the Manitoba Chemical Society with the Canadian Institute of Chemistry might be effected were carefully considered. At the close of the discussion a ballot on the question was taken. This resulted in a unanimous vote in favor of maintaining the individual identity of the Society.

The December Meeting.

On December 14th, Mr. G. Wiberg, of the T. Eaton Company's Research Bureau, gave a paper before the Manitoba Chemical Society on "A Consideration of Some Plant Drugs."

Mr. Wiberg selected the following drugs for discussion: Opium and its chief alkaloid morphine, cocaine, the nux vomica alkaloids strychnine and brucine, digitalis, atropine, hyoscyamine and the most important drugs extracted from cinchona bark—quinine and cinchonine. The preparation, uses, toxicology and chemistry of these substances were dealt with in a very complete and interesting way, and a considerable number of specimens were shown.

While the chemical composition of many of the complex vegetable alkaloids has not been definitely settled, Mr. Wiberg was able to show by reference to the alkaloids under consideration their derivations and allied substances, how the toxicity is affected by the addition or elimination of certain radicals. The habit-forming nature of some of these drugs, particularly morphine and cocaine, was also referred to.

At the conclusion of the paper, Professor Bletcher, of the Pharmacy Dept. of Manitoba University, spoke of the advances which had been made in pharmaceutical practice during the last few years, and after a short discussion the meeting adjourned for refreshments.

The Beet Sugar Industry.

A large proportion of the members of the Manitoba Chemical Society assembled on Jan. 10th to hear a paper from Prof. W. F. Geddes, of the Manitoba Agricultural College, on the "Beet Sugar Industry."

Prof. Geddes spoke of the discovery of the presence of sugar in the beetroot and of the initial efforts to prepare it on a commercial scale. The infant industry, stimulated by the sugar shortage in Europe caused by the Napoleonic wars and assisted by bounties, gradually developed until, during the five year period before 1914, 40% of the world's enormous production of sugar was obtained from the beet.

Dealing with the growing of the sugar beet, the speaker stated that plenty of rainfall, moderate temperatures, and a rich soil free from acid were required. Its production necessitated the use of a great deal of hand labor, but owing to the thorough cultivation which had to be given and to the deep feeding habits of the roots, very beneficial effects to the land followed the raising of this crop.

The process of manufacturing beet sugar was next taken up and clearly described. The beets are first washed and weighed and then sliced into wedge-shaped pieces known as "cosettes." These are fed into the diffusion battery, where the sugar is extracted with water at about 80°C. The residue remaining after extraction is used as a cattle food. The juice is warmed to precipitate the albumins present, and then further purified by treatment with lime and subsequently with CO_2 and SO_2. The purified juice is now concentrated in vacuum and in this way 50% of the total sugar present is obtained as a first crop of crystals. Treatment of the molasses with SO_2 and further evaporation produces a second crop of crystals, while a third crop may be prepared by repeating the operation once again. The concentration of mineral salts in the molasses at length becomes so high that crystallization is prevented, and in order to recover the remaining sugar it is necessary either to dialyze the solution, by which means a considerable proportion of the mineral matter is got rid of, or to precipitate the sugar with pure CaO as tri-basic Ca saccharide.

With regard to the beet sugar industry in Canada, Prof. Geddes pointed out that the production of beets had doubled during the last five years, and that three factories were now operating in Ontario. The beets grown in Eastern Canada are high in sugar, and what is of even more importance, the juice possesses a high purity co-efficient. This is not the case with prairie-grown beets. Efforts to raise sugar beets of satisfactory quality, which have been made at various points in the Prairie Provinces, have so far not met with much success.

A large number of unusually interesting lantern slides were shown at the conclusion of the paper.

A. W. ALCOCK,
Secretary, Manitoba Chemical Society.

SOCIETY OF CHEMICAL INDUSTRY.

Montreal Section.

The fourth meeting for the session of the Montreal Section held on January 19th at the Queen's Hotel, was a joint meeting with the Montreal Branches of the Canadian Institute of Mining and Metallurgy and the Engineering Institute of Canada.

"The Administration of the Explosives Act in Canada," by Lieut.-Col. G. Ogilvie, Chief Inspector of Explosives, Ottawa, and "The Generation of Steam by Electricity," by F. T. Kaelin, Chief Engineer of the Shawinigan Water & Power Co., proved very interesting to the hundred odd members and friends present. The meeting was preceded by the usual informal dinner which has become an institution with the section.

Lieut.-Col. Ogilvie, in his remarks, outlined the conditions which prevailed before the passing of the Act in 1912, followed the development of the organization for its enforcement and explained the different points in the regulations.

The Act was described as regulating the manufacture, testing, storage, importation and transportation of explosives. There are no provisions applying directly to the user. The protection to the user lay in the control exercised over the manufacture, etc., to guard against material being supplied which, with ordinary care in handling, would be liable to cause accident.

Most of the accidents were due to gross carelessness on the part of the user. Many accidents had been traced to negligence on the part of the principals of large concerns in the manner in which their explosives were stored and used.

The Royal Canadian Mounted Police co-operated very closely with the Inspectors by carrying out inspections in conjunction with their other duties.

The explosives used in Canada are largely of home manufacture, only a relatively small quantity being imported. Blasting explosives, etc., are practically all made in the country, while fireworks are largely imported. Exception had been taken to some classes of fireworks the importation of which had been barred on account of their composition, (e.g., crackers containing white phosphorus) and also on account of the violence of their explosion rendering them unsafe in the hands of the young boys likely to use them.

The Department of Mines of certain Provincial Governments issue lists of "Permitted Explosives" which may be used in the underground workings of mines. There are no stations in Canada for testing explosives for this purpose, but the Provincial Authorities are guided in their decisions by the reports of the tests carried out in Great Britain and by the Bureau of Mines in the United States on explosives of similar compositions.

There are 19 factories in Canada licensed to manufacture explosives including one making fulminate of mercury, operating for a short period each year, and five, two of which are in continuous operation, manufacturing fireworks.

"The Generation of Steam by Electricity," by F. T. Kaelin, was the second paper presented. Mr. Kaelin stated that generators of small capacity had been in use for some years in Europe, especially in France and Italy. On this continent they had not been used so extensively but are now being introduced, and the installations are of greater capacity than those used in Europe. (For description of generators see abstract of Dr. Kaelin's paper published elsewhere in this issue.)

In the course of the interesting discussion which followed the paper, Mr. F. J. Hambly, General Manager of the Electric Reduction Co., stated that they had installed a generator at their plant in Buckingham with very satisfactory results.

The meeting, which was one of the best of the season, was adjourned after a hearty vote of thanks to the donors of the papers.

CHEMICAL SOCIETY NEWS ITEMS.

The Canadian Institute of Mining and Metallurgy holds its annual and general meeting in Ottawa from March 1st to 3rd. All members of C.I.C. are specially invited to be present.

Prof. J. Cavalier of the University of Toulouse gave a lecture on "Accomplishments of French Metallurgists During the War" before the Chemical Society of McGill, February 17th. He is Rector of this University.

Harold J. Roast and Charles F. Pascoe, both Fellows of the Institute, gave a paper entitled "Arsenical Babbitts" before the A.I.M.E. in New York on February 21st. This paper dealt with the new arsenical babbitts in regard to metallographic composition, physical tests at ordinary and elevated temperatures, chemical constitution of certain compounds contained therein.

Prof. Dr. Alfred Stansfield, F.C.I.C., gave an address on "The Metallurgy of Welding" before the Welding Society of Montreal on February 13th.

NEW MEMBERS OF CANADIAN INSTITUTE OF CHEMISTRY.

The Canadian Institute of Chemistry continues to grow. The latest additions to the membership are as follows:

Fellows (F.C.I.C.)

Charles Ethelbert Wallin, B.A., 24 Whitney Avenue, Sydney, N.S.
Eudore Giguére, Ch. E., 402 St. Joseph St., Lachine, Que.
George Stafford Whitby, A.R.C.Sc., M.Sc., Ph.D., McGill University, Montreal, Que.
A. Reginald M. MacLean, M.Sc., Ph.D., 24 Chomedy St., Montreal, Que.

Associates (A.C.I.C.)

Henry Newburn Stephens, M.A., 35 Ste. Famille St., Montreal, Que.
James Frith Phillips, B.A.Sc., 232 Dovercourt Road, Toronto, Ont.
Grant McAllister Fowler, B.A., Dryden, Ont.
Ewart Wilfred Forsyth, B.A., Stouffville, Ont.
Harry Ritchie Chipman, B.A., 38 Quincey St., Cambridge, Mass.
Jean D. Chene, B.A.Sc., 163 Notre Dame St., Hull, Que.
Arthur Briant, Esq., 800 Dorchester St., Montreal, Que.
Alfred Edward Aldridge, Ph.C., 22 Ngata St., Palmerston, North New Zealand.

Student Members

H. H. Moor, 63 Tranby Ave., Toronto, Ont.
J. M. Luck, Burwash Hall, Charles St. West, Toronto, Ont.
C. Anderson, R. R. No. 2, Wilton Grove, Ont.
W. A. McLean, 500 Princess St., Kingston, Ont.
J. A. Ritchie, P.O. Box 958, Peterborough, Ont.
A. R. Gordon, 72 Heath St. West, Toronto, Ont.
F. L. Wass, 769 Keele St., Toronto, Ont.
T. E. Everest, 22 Keystone Drive, Toronto, Ont.
J. L. Wilson, 385 Princess St., Kingston, Ont.
H. M. Dignam, 252 Poplar Plains Drive, Toronto, Ont.
W. A. Campbell, 241 Quebec Ave., Toronto, Ont.
H. M. Dilworth, 259 Howland Ave., Toronto, Ont.
A. H. Gee, Trinity College, Toronto, Ont.

NOTICE TO MEMBERS OF CANADIAN INSTITUTE OF CHEMISTRY.

The annual meeting of the Institute will be held at Ottawa during the week of May 22nd. It is anticipated that this will be the best attended and most important meeting of the Institute to date. Memners of Section C of the Royal Society, the Advisory Research Council and the Society of Chemical Industry will be meeting at this time.

ADDRESS ON INCINERATION.

"Incineration, or the Destruction of Garbage by Heat," was the subject of an address given before the Toronto Branch of the Engineering Institute of Canada at the January meeting by Mr. R. R. Knight. The reduction of garbage in order to obtain by-products, such as grease, was impracticable, except by cities of at least 500,000 population, said the speaker, and it was also declared impracticable for a city of less than 15,000 to operate an incineration plant, because there would not be enough garbage to burn without the addition of some other fuel. In spite of the fact that garbage had a moisture content averaging 70 per cent., it had one-quarter the fuel value of coal, and with proper equipment could be so used that it would consume itself, and at the same time furnish sufficient surplus heat to operate a small power plant.

MONTREAL AND TORONTO SECTIONS HEAR ABLE ADDRESS BY DR. C. E. K. MEES.

"Chemistry and the Motion Picture" was the subject of an address given by Dr. C. E. K. Mees, head of the research department of the Eastman Kodak Company, Rochester, N.Y., before the Montreal and Toronto Sections of the Society of Chemical Industry, at their February meetings. It was indeed fortunate that both sections were privileged to hear Dr. Mees on this subject, of which he is undoubtedly recognized as one of the leading authorities.

The Montreal Section held their meeting Monday evening, February 20th, with the Chairman, Mr. H. W. Matheson, presiding. This was not the first time that Dr. Mees had addressed the Society, he having presented one of the leading papers at the Annual Meeting in Montreal last August, when he spoke on "The Preparation of Synthetic Organic Chemicals." The Toronto Section also had the pleasure of hearing him speak last year.

The meeting of the Toronto Section was held at Hart House, Wednesday evening, Feb. 22nd, and despite the fact that one of the very worst tie-ups in the history of the local transportation service had taken place that evening, the attendance was splendid, nearly 80 members and guests being present. Included among the latter were Dr. R. F. Ruttan, President of the Society of Chemical Industry and head of the Department of Chemistry of McGill University; Sir Robert Falconer, President of the University of Toronto; Sir William Hearst, former Premier of Ontario; Mr. S. R. Parsons, President of the British American Oil Company; Dr. J. C. Fields, President of the Royal Canadian Institute; Prof. G. R. Anderson, Mr. S. B. Cornell, Mr. R. F. Wood and Mr. W. A. Bach, managing director for Canada of the Lasky-Famous Players Film Corporation.

The usual informal dinner preceded the business and technical session. At the conclusion of the dinner, the Chairman, Mr. M. L. Davies, called on Dr. Ruttan, and in doing so, Mr. Davies pointed out that this was the first opportunity that the Section had had of welcoming a Canadian as President. Dr. Ruttan received a hearty welcome, upon arising to address the members. He assured them that the choice of a Canadian for President was indeed a high honor to Canada. He felt that the work of the Society in Canada was bearing fruit and that Canadian industries had a much better appreciation of chemists and chemistry than was formerly the case. It was fortunate that Canadian chemists and others interested in chemical progress had escaped the duplication caused in England by the existence of five different chemical societies. Much had already been done in England towards the uniting of the efforts of these different societies.

Continuing, Dr. Ruttan believed that the time was ripe for efforts directed towards the further education of Canadians in things chemical. The work along this line instituted by Dr. Herty in the United States was proving most successful, and the response to newspaper and magazine articles had been really remarkable. In closing, Dr. Ruttan referred briefly to the work in which he is so vitally interested, that of the Advisory Council for Scientific and Industrial Research. The last Canadian Parliament had passed recommendations favorable to the establishment of a Research Institute, but, remarked the speaker, humorously, though the Senate had been "exposed" to the efforts of those favoring the Institute, they (the Senate), had not "taken" to the idea, and had voted it down. There was another critical time approaching and the aid of all those favoring the objects of the Council would be urgently needed.

Following Dr. Ruttan's remarks, Mr. W. A. Bach, of the Lasky-Famous Players Film Corporation, spoke to the members for a few minutes on the distributing or selling end of the motion picture business. His company was this year celebrating its tenth anniversary and during the past ten years had given in film length over 200,000 miles of film entertainment.

The meeting then adjourned to the lecture hall, where Dr. Mees gave the address of the evening.

In dealing with the subject, the making of the motion picture film, Dr. Mees illustrated his lecture with lantern slides which were most elucidating.

In part, he said the development of the motion picture has depended upon improvements in the apparatus for taking and projecting the pictures and in the sensitive film on which the pictures are recorded. The manufacture of film starts with cotton, which, after washing and drying, is treated with a mixture of sulphuric and nitric acid until it has absorbed the right amount of nitric acid, as result of which it becomes soluble. After washing out the excess of acid, it is mixed with the solvents in large condensers, and stirred until completely dissolved. The solution is then coated upon a wheel 20 feet in diameter, having a very smooth surface, from which the film is stripped as it is formed by the evaporation of the solvents. The sensitive emulsion is made by precipitating a solution of silver nitrate with bromide derived from the brine wells of Michigan, the silver nitrate being made by dissolving metallic silver in nitric acid. The making of motion picture films absorbes a significant proportion of the world's production of metallic silver. The precipitation of silver is carried out in the presence of gelatine, and the emulsion, as it is called, is coated upon the film by dipping one side of the film passing over a roller into the melted emulsion. It is then chilled and sets as a jelly and is dried.

The film is slit to the exact width required for the motion picture, 1⅜ inches, and is perforated and packed up in rolls of 200 or 400 feet.

The film is of two kinds, the negative film, which is used for taking the pictures and which is extremely sensitive to light, and the positive film, on which the negatives are printed to produce the pictures projected in the motion picture theatres. The negative film is exposed to the camera in the motion picture studio or out of doors, and is then developed, usually by winding it upon a rack, which is then inserted in a tank of developer. The film, after fixing and washing, is dried on huge revolving wheels. The negative is examined and then printed on to the positive film in a printer so designed that the intensity or time of printing is automatically varied to compensate for changes in the density of the negative, and the positive film is in its turn developed, fixed, washed and dried. Positive films are then examined and joined together to make the continuous roll of film used in production, positives often being tinted with a dye or made on tinted base, or the image toned to some color in order to produce various effects.

Besides the manufacturing, the chemistry of the motion picture deals with the nature of the emulsion and with the changes which go on in it when exposed to light, developed and fixed.

If a picture be examined under a high-power microscope, the image will be found to consist of tiny grains of black silver looking like masses of coke. These grains have in their turn been formed during development from the original silver grains of silver bromide, of which the emulsion was composed, which are crystalline in nature, the effect of light action being to make the silver bromide more easily attacked by the developer, which transforms it into the black metallic silver. The silver bromide which was not affected by light and consequently not changed into silver by developer, is removed in the fixing bath, leaving only the black grains of metallic silver to form the final image.

Dr. Mees also spoke of the fundamental research done on light.

The "light dart" theory alone accounted for the photochemical action and X-rays. By this theory, light consists of intermittent trains of energy, with a uniform front, rather than a continuous wave motion. The investigations going forward at the present time have a fundamental bearing on our knowledge of light and are likely to produce some modifications at least of present standard theories and explanations.

In the discussion which followed the address, Dr. Mees mentioned the general situation existing between science and industry. He deplored the fact that original inventors and university teachers did not receive from industry anything that was due them. He expressed the belief that science alone accounts for the difference in the world between our time and centuries ago. Science makes it impossible to go back to former conditions. In no uncertain tone, he advanced the statement that modern industry was actually parasitic on science, and that industry was just now beginning to pay the debt owed. He anticipated the time when industry would recognize science fully for what she has done, and would see to it that the real sources of her strength were not starved, but generously developed. Dr. Mees addressed the Empire Club of Toronto, Feb. 23rd

OFFICERS OF CANADIAN PACIFIC SECTION, S.C.I.

The officers of the Canadian Pacific Section of the Society of Chemical Industry, for the present session, 1921-1922, are as follows: Chairman, Prof. E. H. Archibald, A.M., Ph.D., University of British Columbia; Vice-Chairman, Prof. R. H. Clark, M.A., Ph.D., University of British Columbia; Hon. Secretary, J. A. Dawson, B.A., F.C.I.C., 326 Howe St., Vancouver, B.C.; Executive Committee: Messrs. G. P. Allen, W. S. Bird, R. Boyd, B. A. Cuncliffe, D. M. Ferguson and Prof. H. M. Thomson.

CANADIAN PACIFIC SECTION, SOCIETY OF CHEMICAL INDUSTRY.

A meeting of the Canadian Pacific Section of the Society of Chemical Industry was held at the Board of Trade, Vancouver, on Wednesday, February 1st, at which Dr. M. G Marshall of the University of British Columbia read a paper on the "Absorption of Gases on Charcoal." The paper dealt with the results of a most interesting and important research carried out at the Research Laboratory of Physical Chemistry at the Massachusetts Institute of Technology by

Dr. F. G. Keyes and the speaker. The investigation was undertaken as a consequence of the use of charcoal in poison gas masks during the war.

The preparation of exceedingly sensitive apparatus was described for measuring the heat emitted when various gases reacted with highly purified charcoal. From the resulting heat effects it is concluded that oxygen and probably chlorine, form chemical combinations with the carbon at the surface of the charcoal. Other gases such as hydrogen, do not combine chemically with the carbon of the charcoal and they are therefore absorbed in very small proportion.

This work and that of previous investigators indicates that the absorption of gases by charcoal is not due to the small size of the pores, but rather to the large surface offered for attachment of the gas molecules. The actual forces causing absorption are in some cases due to both primary and secondary chemical valences while in other cases, secondary valences alone are involved.

A number of practical applications were instanced, such as the removal of nitrogen from helium gas for the use of the latter in observation balloons and dirigible airships. The paper was illustrated by lantern slides showing diagrams and photographs of the apparatus used. Dr. Marshall is continuing the investigation at the University of British Columbia. At the conclusion of the address, Prof. Archibald, Chairman of the Section, and the several members present, held a very interesting discussion on the subject.

After the meeting, steps were taken to form the British Columbia Chemists' Club, Mr. Horace Freeman being appointed President and Mr. Norman Armstrong, Secretary-Treasurer. The Club will specialize in the study of local chemical industries and opportunities.

J. A. DAWSON,
Hon. Secretary.

CLAY PRODUCTS MEN PROPOSE CERAMIC COURSE.

At their recent meeting in Toronto the Canadian National Clay Products Association proposed that the University of Toronto undertake to establish a course in ceramic engineering. The Association has been very active in this matter, and has installed some equipment in the Toronto Technical School.

Mr. Gordon Keith, secretary of the Association, stated that there had been a falling-off in the number of brick plants since 1912. In that year, 271 were operating, while only 163 are working at the present time.

The general outlook for business, as expressed by R. H. New, the president, was fair. A Department of Ceramics had been opened by the University of Saskatchewan, with Prof. W. G. Worcester in charge. A survey of ceramic materials had been made. Methods of working were improving, and machinery was being more extensively used.

Mr. William Burgess, of the Don Valley Brick Works, gave an instructive paper on "Handling Clay with Conveyors."

The elected President for 1922 is Mr. R. H. New, of Hamilton, Ont.

J. T. DONALD & CO. MOVE TO NEW QUARTERS.

J. T. Donald & Co., Ltd., Montreal, announce their removal from 318 Lagauchetiere Street West, to new and larger premises at 40-42 Belmont Street, corner of St. Genevieve Street. This removal is due to the growth of their business as analysts, assayers and consulting chemists and engineers.

World Conditions and News in Chemical Fields.

(Special Correspondence to Canadian Chemistry and Metallurgy by Our London Representative.)

Taking chemicals, drugs, dyes and colors, it appears that the United Kingdom imported during 1921 goods worth only £12,682,196, as compared with £34,329,497 for the previous twelve months, and with £13,335,795 in 1913; thus the trade was worth less, both in value and quantity, than it was in pre-war days. The same remark applies to the export trade which, in 1921, reached £19,057,281, as compared with £40,535,725 for 1920, and with £19,533,388 for 1913.

United Kingdom Exports, 1921.

Taking the chemical trade as a whole, the following figures represent the enormous decline in exports of the main products during 1921, as compared with 1920 and 1913:—

		1913.	1920.	1921.
Sulphuric Acid	Cwts.	170,503	145,051	53,728
" "	Value	£62,722	£167,605	£71,546
Tartaric Acid	Cwts.	16,401	29,427	8,809
" "	Value	£88,135	£491,845	£121,220
Sulphate of Ammonia	Tons	323,054	109,620	128,433
" "	Value	£4,390,547	£3,658,625	£2,659,140
Coal Tar Products (not dyes)	Value	£1,515,900	£2,858,622	£1,150,840
Copper Sulphate	Tons	75,633	19,832	28,005
" "	Value	£1,701,219	£784,341	£1,016,588
Glycerine	Cwts.	242,061	310,107	85,746
"	Value	£821,381	£1,576,136	£447,642
Potassium Compounds	Value	£258,996	£820,190	£204,706
Sodium Compounds	Cwts.	7,266,862	8,664,862	4,556,341
" "	Value	£1,788,099	£7,018,025	£3,344,712
Drugs	Value	£2,351,781	£5,186,845	£2,230,325
Painters' Colors	Cwts.	2,414,910	1,479,604	886,115
" "	Value	£3,231,525	£5,631,868	£2,732,547

Among British Chemical Industries.

British industry generally, following the lead of the United States and Germany, has made remarkable strides in the direction of unification during the last few years, and the movement has received added impetus as the result of the necessities proved during and since the Great War. The merging process appears to have started in the "heavy" chemical trade, the great house of Brunner, Mond, Limited, being well-known throughout the world in this connection. The acquisition of controlling interests in other undertakings has always been an important feature of this company's policy, but this movement proceeded rather slowly until 1911, when a large holding was obtained in the soap businesses of Joseph Crosfield & Sons and William Gossage & Sons by the exchange of shares of the nominal value of £715,000. The most important development took place in 1916, when an agreement for mutual co-operation was entered into with the Castner-Kellner Alkali Company, over ninety per cent. of this firm's capital being acquired in 1920.

The first effort to establish the color-manufacturing industry on a national basis was that made in 1915 by the formation of British Dyes, Limited, to which reference has already been made in this journal. This concern is now merged in the British Dyestuffs Corporation, which is waging a difficult fight against post-war importations of German dyes, its own output representing about seventy-five per cent. of the domestic production.

During the year 1918 Explosives Trades, Limited (now Nobel Industries, Limited) was formed as a holding company, and acquired on the basis of an exchange of shares almost the whole of the share capital of thirty-three concerns. In addition the company secured interests (either direct or indirect) of seventy-five per cent. or more in fourteen other concerns, and holdings in excess of thirty-three and one-third per cent. in twenty-four firms. Over eighty companies are now more or less closely connected with Nobel Industries, Limited. All the explosives companies in the United Kingdom, with the exception of three relatively small concerns, are controlled by the combine, but at the moment the bulk of the capital is employed on the manufacture of chemical products other than explosives.

British Glues and Chemicals, Limited, represents a complete merger of the principal firms manufacturing colloidal products and dates from the year 1920. In 1919, however, an amalgamation of interests in the chemical industry brought about the fusion of Nitrogen Products and Carbide Company, Limited, with Alby United Carbide Factories, Limited, but the adverse industrial conditions which developed early in 1920 quickly brought about instability resulting in liquidation.

In other branches of the heavy chemical industry large amalgamations were in existence before the war, notable instances being the combine known as Borax Consolidated, Limited, formed in 1899. The remarkable success which has attended this operation is largely explained by the fact that complete control was obtained over all the important sources of raw material. The early career of the great United Alkali Company, a combine formed in 1890, was far from fortunate, but since its reorganization in 1913 and the formation in 1915 of the Salt Manufacturers' Association (including, also, the Salt Union, Limited), the position has been much better. This syndicate has thirteen members, and it is estimated that the Salt Union alone is responsible for about sixty per cent. and the rest of the Association for thirty per cent. of the total output of salt in the United Kingdom.

To facilitate development, British Oxygen, Limited, and British Cyanides, Limited, have acquired large interests in associated companies during recent years.

British Industries Fair.

A special feature of the British Industries Fair, February 27th to March 10th, was the Chemical Hall. This hall was occupied entirely by 50 or 60 chemical manufacturers, thoroughly representative of British chemical industry.

In addition to tar products and heavy chemicals, in which Great Britain has always been pre-eminent, the exhibits of fine chemicals and dyes were particularly good.

Fine Chemicals Prices.

A general comparison of prices in Great Britain at the end of December, 1920, and prices current at the end of December, 1921, show, in almost every case, a considerable fall. This applies equally to pharmaceutical and perfumery synthetics. The average difference in price taken on 35 specific pharmaceutical chemicals shows a fall of 33 per cent.; calculating in the same way on the average difference on 26 of the more ordinary synthetic perfumes, the drop is over 40 per cent.

Safeguarding of Industries Act Condemned.

At a meeting of the Chemical Merchants and Users' National Vigilance Committee a resolution was passed with regard to the Safeguarding of Industries Act, 1921. The resolution set forth that the committee were of opinion that the published list of key industries was wider and more far-reaching than was intended. Especially in relation to chemicals, many of the articles listed in the Act do not come under the definition of key industries, and are not made in the United Kingdom. They should therefore be deleted from the list.

Mineral Wealth of Morocco.

The discovery of from 200 to 600 miles of copper deposits in French Morocco, with an ore seam averaging about 150 feet in depth and one foot in thickness, has caused renewed interest to be taken in the mineral wealth of that country. Extensive iron ore deposits are known to exist; lead and zinc are also to be found: but perhaps the most immediate source of wealth will be the working of the phosphate beds of Morocco, the mines of Gafsa, Tebessa, M'zeita, and Djebel-onk being well known. It has been estimated that the value of the phosphate beds in French Morocco exceeds £3,600,000,000 sterling, and Government experts hold the view that this year they should yield a revenue of between one and one and a half millions sterling—a sum which will be utilized largely in the improvement of local agriculture. Factories have been erected near the mines for manufacturing superphosphates.

German Chemical Exports.

New regulations covering the import of foreign and export of German chemicals have been formulated by the different sub-committees of the German Federal Foreign Trade Control Bureau for Chemicals.

The export of zinc dust will be restricted with a view to avoiding a total embargo which might otherwise become necessary. For sulphide of sodium and antichlor, the minimum export prices will henceforth be in foreign currency. Export of sulphide of sodium will be permitted to a limited extent while the import embargo remains in force. Permission will also be given for the import of natural camphor (Japanese and Chinese), but the import of synthetic camphor will be prohibited until further notice. Export permits for the latter commodity will be granted provided domestic consumers are adequately supplied.

The Oppau Factory Re-opens.

The Badische Aniline and Soda Factory resumed operations in their Oppau works—where the explosion occurred—at the beginning of December. The works have now resumed the manufacture of ammonia, but the production of ammonium sulphate is to be left alone for the time being.

Chemical Industries in Poland.

The chemical industry connected with agriculture was already very far advanced in Poland before the war, for it constituted one of the sources of her great wealth; it should soon not only return to its former height of development, but also make further progress. Sugar constitutes the most important branch of this industry—the pre-war output amounted to 700,000 tons. Many sugar factories were destroyed during the war and there was great difficulty in obtaining sufficient ground for the cultivation of beetroot; in consequence the output of sugar has diminished considerably—to one-quarter to one-third of the pre-war production. Distilling of alcohol from potatoes is a highly developed industry in Poland, and starch and potato syrups are produced in considerable quantities.

There are several large factories employed in producing soap, candles and glycerine, and in extracting fats. To-day the outlook is more hopeful for this special branch. The manufacture of glue and gelatine is also well developed.

Mineral Fertilizers in Spain.

Mineral fertilizers are finding a growing market among the farmers and orchardists of Southern Spain, according to reports of the United States Consuls at Cadiz and

Seville. A steady increase is noted in the amount used, and 20,000 tons has been given as an estimate of the probable consumption this year in the Seville district alone.

Soap Manufacture in China.

According to a report by the American Vice-Consul at Hankow, there are four large native soap factories in that city, with an estimated output yearly of 60,000 cases. The largest of these native factories has little or no modern machinery.

Chilean Nitrate Trade.

Sales of nitrate, it is believed, will show an improvement this year. France has already purchased 200,000 tons for delivery in the spring, while other European markets have contracted for 50,000 tons. Sales to Europe during the nitrate year 1921-22, it is calculated, will reach a total of 1,000,000 tons. The United States during the same period will purchase about 650,000 tons, of which 200,000 tons are already sold, while an additional 200,000 tons are ready for shipment at a moment's notice. Japan and other markets have purchased 100,000 tons during the current year and will absorb another 100,000 tons within the next six months.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy.)

Quite the outstanding event of the month in mining circles is the announcement of the probable output of the Premier mine, which recently was made by Dale L. Pitt, general manager for the Premier Gold Mining Company Mr. Pitt stated that the tramway is now delivering 100 tons of high-grade ore daily to the ore-bins at Stewart, whence it is shipped periodically to the smelter at Tacoma A little later, this amount will be doubled, when ore of a lower grade will be shipped to the Granby Company's smelter, at Anyox. Besides the ore that is shipped, the company is milling 100 tons of second-grade ore daily, and from this about 400 tons of concentrate is obtained monthly. This is sent to Tacoma. The tailing from the concentrating plant is re-ground and cyanided, and from this between $40,000 and $50,000 worth of precipitate is obtained monthly, and is sent to the Selby smelter, on San Francisco Bay. On an average between 350 and 400 men were employed at the mine last year. The tramway, which is 11½ mills long, 10 miles of which runs through Alaskan territory, is the longest single-cable-drive tramway in the world. It has 153 towers, 3 angle-stations and 12 tension anchors. Mr. Pitt gave no information as to the values of the respective products, but, judging by the ore and by the concentrate that previously has been shipped, the monthly output of the mine cannot fall far short of three-quarters of a million dollars in value.

Copper Mines Resuming Operations.

Those copper mines that closed during the depressed price of the metal gradually are resuming operations. The Britannia Mining and Smelting Company are erecting a new mill building of steel and concrete.

The Tidewater Copper Company has resumed operations at its Indian Chief mine, at Sidney Inlet, Vancouver Island, after a shut down of about fifteen months. An ore reserve of 200,000 tons of two per cent. copper ore has been developed and a plant capable of treating 300 tons of ore daily by the all-flotation process has been erected. A 3000-foot tramway connects the mine and the mill, and waterpower sufficient to drive the whole of the mining and milling machinery has been developed. The flotation plant recovered 95 per cent. of the copper content of the ore, and the product marketed averaged 38 per cent. of copper with low gold and silver values.

Lead Mines Slow.

With the exception of the Silversmith mine, in the Slocan, which is working its 150-ton mill at capacity, and the Consolidated M. & S. Co.'s Sullivan mine, lead mining in the Province is being resumed only slowly.

Gold Mining Attractive.

Present indications point to a considerable revival of placer mining in the Cariboo district. Gold mining probably is the most attractive mining enterprise at the present moment, because the cost of labor and suppiies has dropped, and there is a sure market for the whole of the output. Several United States concerns have purchased and bonded placer leases, and already a good deal of machinery has been freighted to the respective claims.

Guggenheims Secure Further Interests.

A deal of considerable importance was put through recently, by which J. A. Bush and Grant Mahoot have sold their one-third interest in the B. C. Silver Mines, Ltd., to the Guggenheim interests for $100,000. The remaining interest in the property is held by the British Silver Corporation, of London. The B. C. Silver Mines claims adjoin the Premier mine, in which the Guggenheims now hold a controlling interest, so that it is likely an amalgamation between the two concerns may be made.

Ontario Interests May Invest in Salmon River District.

It is understood that several of the large Ontario silver mining interests are looking to the Salmon River district mines as a place for investment, and that a number of examinations will be made during the coming season. Unfortunately, these concerns want developed mines, and up to now there are few of such in the district. The district is badly off for transportation conveniences, and prospecting is anything but a poor man's game; and it has been the poor prospector who has opened up most of the mines in British Columbia. If the Ontario companies want to invest in this district they must be prepared to undertake their own developing, that is, if they want mines with a proved ore-reserve.

BRITISH COLUMBIA INDUSTRIAL NOTES.

The British Columbia Cement Company has received an order for 3,000 sacks of cement, which will be shipped from the company's Tod Inlet plant by the next steamer of the French line sailing for Salina Cruz, Mexico. The cement company has appointed agents in Mexico, Guatamala, San Salvador, Nicaragua, Costa Rica, Honduras and Panama, and expects to open up a good trade between here and Mexico and Central America. The company, through the Victoria Chamber of Commerce, will endeavor to induce the Dominion Government to start a service between British Columbia and Central and South American ports, believing that thereby much trade might be brought to this province.

The Whalen Pulp and Paper Company recently has been shipping pulp from its Port Alice and Swanson Bay plants directly to New York by way of the Panama Canal.

The Imperial Oil Company will re-start drilling operations at Pouce Coupé on March 1. Three carloads of casing and other drilling supplies are being transported over the snow from Spring River to Pouce Coupé. An attempt will be made to induce the Dominion Government to connect Ponce Coupé by rail with the Canadian National system at Brule.

The Terrace Oils, Ltd., has let a contract to Boyle Bros., of Spokane, to sink a 1,500-foot bore-hole on G. E. Keith's farm, near Terrace. The Imperial Oil Company has made arrangements to sink a trial bore near Kitsumgallum Lake, in the Terrace district.

The Union Oil Company, of Canada, a subsidiary of the Union Oil Company, of California, is erecting gasoline stations in Vancouver with the idea of extending business later to other Canadian cities.

A matter of scientific, rather than commercial, interest is the recent discovery that some of the copper ore from the Valdez Island Copper Company's Ingersoll mine, on Quadra Island, is markedly radio-active. Photographs have been taken of metal objects by the aid of rays emitted from the mineral, and the mineral is said visibly to excite a scintillascope. Samples of the mineral have been sent to McGill University, and to universities in the United States and in England.

RECENT INCORPORATIONS.

Krystal Corp. of Canada, Montreal; Drug Sales Corp. of Canada, Montreal; Moira Minerals, Ltd., Belleville, Ont.; Drug Specialties, Ltd., Toronto; Wm. C. Bealmear Chemical Co., Ltd., Toronto; Dye Intermediates, Ltd., Toronto; Canadian Essential Oils, Ltd., Toronto; British Metal Corp., Ltd., Montreal; Canadian Conveyor Co., Ltd., Brantford, Ont.; Beldame Asbestos Packing and Mineral Mfg. Co., Ltd., Toronto; British Xylonite Co. of Canada, Ltd., Toronto; Tanners Chemical Co., Ltd., Toronto; Westons Drug Co., Ltd., Toronto; Electro-Chemical Co., Ltd., Niagara Falls, Ont.

CANADIAN SUGAR IMPORTS AND EXPORTS, 1921.

The total amount of raw sugar imported into Canada during 1921 was 719,163,891 pounds, as compared with 771,187,636 pounds in 1920. As sources of these imports a decided reverse is noted in the case of Cuba. In 1920 Cuba led in imports into Canada, with 357,778,142 pounds, but in 1921 dropped to 135,629,772. The largest importer in 1921 was British Guinea, with 151,850,286 pounds. The United States ranked second in 1920, with 172,080,239 pounds, and third in 1921 with 125,597,470. The drop in imports from Cuba during 1921 is, to a considerable extent, made up by increased purchasings from countries from whom relatively small amounts were imported by Canada during 1920. For instance, imports from San Domingo rose from 76,853,245 pounds in 1920 to 99,967,334; imports from Barbadoes rose from 17,219,120 pounds in 1920 to 46,260,142 in 1921; imports from Peru rose from 31,789,842 pounds in 1920 to 59,823,328 in 1921; imports from St. Fili from 10,464,556 pounds in 1920 to 29,717,365 in 1921. A remarkable increase is noted in imports from other British West Indies islands, from whom 18,294,156 pounds were received in 1921 as compared with only 1,716,347 in 1920. British Guiana, which, as stated, ranked first in 1921, with 154,850,286 pounds, sold only 53,757,291 pounds to Canada in 1920.

In imports of refined sugar the United States comes first, with 14,750,886 pounds for 1921 of the total imports from all countries amounting to 20,571,959. The imports of refined sugar in 1920 were about half of the 1921 total—9,684,531 pounds.

Canada is also an important exporter of refined sugar, as well as an importer, due to the fact that two of the largest refineries are situated very advantageously for ocean traffic. In 1921 the total exports of refined sugar were 86,765,970 pounds, and in 1920, 69,014,171 pounds, a substantial increase. The United Kingdom, Newfoundland and the Netherlands are among Canada's best customers for refined sugar.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported specially for "Canadian Chemistry and Metallurgy" by A. E. MacRae, Ottawa.

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Manufacture of Malleable Iron Castings.

G. H. Wooby, 215067, January 10, 1922. An alloy which when cast is malleable, contains Fe 78 to 86%, Ni up to 12%, Cu up to 10% and Mn up to 12%.

Process of Making Alkyl Sulphuric Acid.

G. P. Adamson, 215073, January 10, 1922. MeOH and SO_3 is continuously introduced into a dominant bath of methyl H_2SO_4 the temperature of which is kept at 100-150° F. The sp.g. of the methyl H_2SO_4 formed is regulated by the rate of feeding the MeOH and SO_3.

Treatment of Leach Liquor.

F. O. Stillman, 215087, Jan. 10, 1922. Leach liquor containing sulphates of Fe, Al, Ni and Mn is treated with $CaCl_2$ to form chlorides of the metals and $CaSO_4$ which precipitates. The Fe and Al are precipitated with limestone and the Ni and Mn are removed by electrolysis.

Process for Purifying Graphite and Carbon.

C. W. Woodruff and R. H. Pausch, 214807, December 27, 1921. Graphite or C bearing material is purified by bringing gaseous HF into intimate contact with the material and then washing the soluble compounds with the so treated material.

Rubber Battery Vent.

H. Weida, 214867, December 27, 1921.

Alloy Steels.

A. Pacz, 214869, December 27, 1921. An alloy steel, contains from .75 to 5% of B and at least one other rarer metal.

Carbonaceous Materials and Process of Making Same.

A. T. Hinckley, 214871, December 27, 1921.

Graphitized Electrodes.

A. T. Hinckley, 214872, December 27, 1921.

Flotation of Minerals.

R. E. Sayre, 214877, December 27, 1921. A small amount of a ketone condensation product such as mesityl oxide $(CH_3)_2C$; CH, CO, CH_3 is used as a frothing agent in concentrating ores by flotation. Agent having marked selective or collecting properties may be used with the above product. It is advantageous with certain ores to add to the pulp a small amount of alkali.

Flotation of Minerals.

R. E. Sayre, 214878, December 27, 1921. An aldehyde condensation product such as the product resulting from the action of H_2SO_4 on aldol is used as a frothing agent in concentrating ores by flotation.

Battery Terminals.

H. S. Brown, 255479, December 20, 1921.

Battery Terminals.

H. S. Brown, 214720, December 20, 1921.

Production of Hydrogen.

A. R. Griggs, 214739, December 20, 1921. In the production of H by the oxidation and reduction of Fe materials, the reduction period is divided into periods, an initial reduction being effected in one retort and an intermediate reduction in another with gases derived from other retorts on later periods of the reduction phase. The gases from the reduction phase are used for heating the reaction material.

Process for Treating Potassium Bearing Silicates.

E. Levitt, 214636, December 13, 1921. Feldspar is treated with a flux containing B_2O_3. The melt is ground suspended in water and treated with SO_2 to form bisulphites. The sludge is filtered and the SiO_2 may be converted into waterglass and the filtrate treated for the recovery of the metal content of the feldspar and the boric acid.

Process for Fixing Atmospheric Nitrogen.

C. P. Hidden, 214680, December 13, 1921. The cyanids formed by N fixation in a column of briqueted reaction material as in the Bucher process is drawn off into a cooling hopper beneath the reaction column while in fluid condition and solidified by a current of N circulated about the hopper. An apparatus is also described.

Furnaces for Nitrogen Fixation.

C. P. Hidden, 214679, December 13, 1921. Solid materials such as briquets of a mixture of Na_2CO_3, pulverized coke and Fe are passed downwardly through a reaction chamber in which an upward current of N is maintained. The chamber is positioned vertically and is heated externally by combustion gases and by a gas fired heating thimble within and concentric with the reaction chamber. The walls of the chamber and the heating thimble are so constructed as to avoid clogging by the charge when it becomes sticky. The N supply pipe is led through the heating thimble to pre heat the N.

Process of Producing Interactions Between Gas and a Liquid.

P. W. Webster and W. K. Boynton, 214682, December 13, 1921.

Zinc Smelting Furnace.

B. Raeder, 214692, December 13, 1921. An electric furnace for Zn production has a chamber heated with energy supplied through C electrodes, a superposed chamber for drying and glowing heated by the combustion of gas and a drying compartment above the latter chamber. The charge is fed successively through the three compartments.

POSSIBILITIES FOR DEVELOPMENT OF CERAMIC INDUSTRY IN CANADA.

Dr. H. P. Bates, chief of the division of structural materials of the Bureau of Standards, Washington, during the course of an address on "Structural Ceramic Products" before the Royal Canadian Institute at Toronto, February 18th, declared that opportunities certainly existed in Canada for further developments in the ceramic industry. The ceramic industry was not, Dr. Bates said, a mere decoration of pottery, as commonly understood; but a chemistry of the silicates. The best feldspar used in the industry was found in Canada, and dishes made of it did not stain. In the manufacture of glassware, English tableware, etc., most of the clays came from Europe, but such advances had been made in the industry in the United States that some of the United States' clays were used. Portland cement is now being made at the rate of 100,000,000 barrels yearly.

One of the most important features of the Bureau's research work was the attempt to secure a brick which would resist fire to such a degree that no appreciable expansion occurred. The brick or cement at present used to cover steel in skyscrapers was not in many instances sufficient to prevent buckling even in light fires. The Bureau was conducting a series of tests with concrete with this point in view.

MINERAL PRODUCTION, ONTARIO, 1921.

Production of Gold in Ontario During 1921 Shows 25 Per Cent. Increase Over 1920 Production.

The Province of Alberta is rapidly coming to the fore as one of the leading gold producers of the world. The preliminary report on the mineral production of Ontario. issued by the Ontario Department of Mines and compiled by Mr. W. R. Rogers, statistician of the department, shows that in 1921 the gold mines of Ontario produced 709,509 ounces of gold, valued at $14,624,085, an increase in production of 25 per cent. over the amount produced in 1920. While the figures for the production of gold in the State of California for 1921 are not at hand, it is known that Ontario's production came very close to that of the "Golden State." The Porcupine district produced the great bulk of Ontario's gold, with a production of 633,557 ounces, valued at $13,095,630. The Hollinger Consolidated was the largest producer in the Porcupine district, with a production of 435,404 ounces, valued at $8,999,796, obtained from 1,072 493 tons of milled ore. The next largest gold producer was the Dome, with 110,316 ounces, valued at $2,280,237, obtained from 335,680 tons of milled ore. McIntyre was third with 87,837 ounces, valued at $1,815,597.

The Kirkland Lake district produced 73,773 ounces of gold valued at $1,524,851. In the Kirkland Lake district the Lake Shore mine was the largest producer, with a production of 23,896 ounces, valued at $493,940, obtained from 21,817 tons of milled ore. The Wright-Hargreaves was second in Kirkland with 22,617 ounces, valued at $467,504, obtained from 36,053 tons of milled ore. The Teck-Hughes came third with 15,582 ounces, valued at $322 028, obtained from 34,693 tons of milled ore. The Kirkland Lake mine was fourth with 11,678 ounces, valued at $241,379, obtained from 43,966 tons of milled ore.

There was also a production of 179 ounces obtained from the refining of nickel-copper ores valued at $3,604.

Silver Production.

The production of silver in Ontario in 1921 shows a great decrease in value due to the drop that occurred in the price of silver. In 1920 the average price for silver was 100.9 cents per ounce, and in 1921 only 65.6 cents. The total production of silver from Ontario mines in 1921 was 8,412,059 ounces, valued at $5,497,160, as compared with 11,065,415 ounces in 1920, valued at $10,873,496. Production of silver was, therefore, considering the slump in value, well maintained. Several silver mines also closed down during the past year, due to power shortage, and have not yet re-opened. During 1921 Mr. C. W. Knight, geologist of the department, completed an underground survey of the Cobalt mines.

Lead.

Lead was the only mineral outside of gold showing an increase in production, a total of 3,570,222 pounds, valued at $190,843, being produced, as compared with 2,232,253 pounds in 1920, valued at $179,714.

SUMMARY OF MINERAL STATISTICS, 1921.

The following table, subject to revision, summarizes the mineral production of Ontario for 1921. As far as possible, the figures represent quantities shipped and values received for marketed products. Tons throughout are short tons of 2,000 pounds. Final figures for 1920 are included for comparison.

Product	Quantity		Value	
	1920	1921	1920	1921
Metallic			$	$
Gold, ounces	565,283	709,509	11,686,043	14,624,085
Silver, ounces	11,065,415	8,412,059	10,873.496	5,497,160
Platinum metals, ounces..	19,056	(a) 915	1,996,535	51,060
Copper, pounds	6,825,772	3,070,719	1,041.994	356,708
Nickel, metallic, pounds..	11,015,692	5,430,147	3,852,141	1,825,359
Nickel, oxide, pounds....	4,890,571	1,402,019	1,151,490	285,391
Cobalt, metallic, pounds..	167,750	32,718	392,926	98,228
Cobalt, oxide, pounds....	569,182	155,554	1,210,810	354,418
Other nickel and cobalt compounds, pounds ...	161,442	108,814	16.991	114,069
Lead, pig, pounds.......	2,232,253	3,570,222	179.714	190,843
Copper in matte exported (b) tons	11,715	3,686	2,928,750	737,142
Nickel in matte exported (b) tons	21,371	4.850	10,685,500	1,939,851
Iron ore and briquettes (c) tons	68,616	100	60,958	459
Iron, pig (d) tons.......	67,164	82,318	2,204,205	2,079,729
Total Metallic		....	48,281,553	27,574,202
Non-Metallic				
Actinolite, tons	100	78	1,160	975
Arsenic, crude, white, lbs.	3,781,389	2,982,525	432,434	233,763
Clay products—				
Brick, common, M.....	123,551	99,463	2,209,265	1,743,094
Brick, fancy pressed, M.	32,559	31,481	809,126	673,087
Tile, drain, M.........	9.784	9,910	359,373	250,040
Tile, roofing, bldg., M.	58,737	....	369,530	211,529
Pottery	....	....	127,049	67,985
Sewer pipe	....	....	860,811	939,464
Cement, Portland, bbls...	2,035,594	2,723,072	4,377,814	6,425,266
Corundum, tons	190	402	27,000	50,250
Feldspar, tons	37.335	15,506	268,295	114,059
Fluorspar, tons	3,704	115	67,381	1,744
Graphite, crude and refined, tons	1,956	363	132,882	23,273
Gypsum, tons	74,707	84,765	404,162	433,053
Iron Pyrites, tons	148 651	19,375	618,283	91,604
Lime, bush.	4,982,912	2,610,129	1,799,763	1,172,680
Mica, tons	717	222	51,394	29,630
Mineral water, imp. gals.	127,150	....	15,059	9.000
Natural gas, M. cu. ft....	10,545,000	8,590,000	3,163,500	2,953,000
Peat, tons	3,900	500	15,600	2.000
Petroleum, crude, bbls....	181,750	172,859	724,145	466,716
Quartz and silica brick, tons	94,650	12,957	366,441	74,635
Salt, tons	206 612	149,599	1,544,867	1,509,287
Sand and gravel, cu. yds.	2,162,241	1,412,956	1,390,704	668,098
Sand-Lime Brick, M.....	27,703	....	407.766	456,700
Stone, bldg., granite, etc..	....	....	3,944,972	1,812,863
Talc, crude, ground, tons.	20,359	9.967	306,319	140,390
Total non-metallic....	....	....	24,795,194	20,554,185
Add metallic	....	....	48,281,553	27.574,202
Grand Total	....	....	73,076,747	48,128,387

(a) Recoveries from Canadian refineries only.

(b) Copper and nickel exports in the form of matte were valued, respectively, at 12½ and 25 cents per pound in 1920, and at 10 and 20 cents in 1921.

(c) Exports and shipments to points other than Ontario blast furnaces.

(d) Proportional product from Ontario ore smelted. Figures cover only the first nine months of 1921.

CANADA'S COAL OUTPUT, 1921.

The output of coal from Canadian mines during the year 1921 amounted to 15 million short tons, valued at $74,273,000, or $4.97 a ton. In 1920 the total output was 16.9 million tons, and in 1919 13.9 million tons, so that although the output in 1921 was 12 per cent. lower than in 1920, it was more than a million tons in excess of the 1919 production. According to the report covering coal production for 1921, recently issued by the Dominion Bureau of Statistics, Ottawa, Alberta led all other provinces with an output of 5.8 million tons; Nova Scotia, 5.7 million tons; British Columbia, 2.8 million tons; Saskatchewan, 332,000 tons, and New Brunswick 180,000 tons. During 1921 Canada exported nearly two million tons of coal, or a little better than 13 per cent. of the quantity mined. The total imports of coal into Canada during 1921 amounted to 18,102,620 short tons, of which 13,536,250 tons were bituminous and the balance, 4,566,370 tons, anthracite. The total importations for 1921 amounted to 87 per cent. of the quantity imported in 1920.

COMPANY NOTES.

The financial report of Shawinigan Water and Power Company, as presented at the annual meeting, held in Montreal on February 21st, showed a balance of $1,515,813 remaining for common stock dividend, being equal to 7.58 per cent. on the common stock, upon which the rate of 7 per cent. was paid. President Aldred stated that bonds to the extent of $4,375,000 were sold in New York during 1921 at satisfactory prices. He pointed out that it would be advisable to issue further capital stock, for financing purposes, and accordingly application had been made to the Legislature to increase the authorized capital to $40,000,000. In view of the fact that the war-time capacity of some of the subsidiary plants was in excess of the present demand, Mr. Aldred said that directors had deemed it advisable to readjust these subsidiary companies' accounts, and for this purpose $304,544 would be taken from the reserve.

Owing to the depressed industrial conditions during 1921 construction work was slowed down, and the completion of the new power developments at Shawinigan Falls had been postponed to September 1, 1922.

Chemical, Oil and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points

CHEMICALS.

March opens with the trading in chemicals, both heavy and fine, decidedly more active than was the case one month past. During February business improved steadily; enquiries became more frequent, and some very fair business was placed both at Montreal and Toronto. The rubber factories are getting busier day by day, and chemical houses have recently succeeded in doing some very good business with rubber manufacturers. The demand from the paint and varnish and color works has also increased, and taking things generally, business seems to be considerably improved. So far as prices go there is not a great amount of change one way or the other, although active competition has succeeded in some lowering of quotations on certain chemicals that were thought to have reached the bottom mark some weeks ago. The heavy chemicals, however, have been least affected by this price cutting, and the stability noted to the heavy chemical offerings at the beginning of February, shows signs of continuing.

Bleaching Powder—Trading has not been very active in bleach, and quotations are going at from .03½ to .04c. per lb. Buying from the paper mills is not very keen, but is expected to improve very shortly.

Caustic Soda and Soda Ash—There is a fairly good trade going in caustic soda and soda ash, much better than a month ago. Quotations on caustic are from .06 — .06½c. on the ground, and from .04¾ to 05½c. on the solid. Quotations on soda ash are from $2.85 to $2.90 per cwt., though some has been sold in quantity at as low as $2.75.

The heavy acids remain steady, though business is not very active, but is gradually improving. Quotations on calcium chloride have declined $2 per ton on both the flake and the fused.

Iodine and the iodine compounds are all advanced. Yellow prussiate of soda remains extremely scarce and prices are high, there being very little obtainable below 18c. Borax, crystals, have declined about 1c., and boric acid is quoted as low as 11c.

Talc and Whiting—All grades of talc are advanced $1 a ton, and business at the mines is reported good. There is also a good trade going in whiting, and both the English and American grades are selling at $30 per ton on good sized orders. (See quotation lists following).

Turpentine, Linseed, etc. Quotations on linseed oil have jumped to $1.10 on the raw grade in 5 bbl. lots and upwards. The Argentine crop was away below expectations. Rosins are remaining steady, but turpentine declined to $1.25 a gal.

METALS.

The metal market shows signs of improvement in most lines except copper, which remains dull. It is felt that the American copper producers misjudged the situation and produced too heavily, the result being a loaded market, which can only be "unloaded" as general industrial conditions improve. Steel mills are much busier than a month ago, and the first of March finds Canadian steel producers getting ready for what they confidently expect will be a fairly good season. Lead, zinc and tin have declined, and it is difficult to say just what trend the market will take in tin, though lead and zinc are fully expected to early recover the declines registered in February.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.75— 5.25
Ammonium Bromide	Lb.	.. — .38
Aluminium Sulphate, bags	100 Lbs.	.. — 2.50
Aluminium Sulphate, iron free	Cwt.	.. — 4.50
Ammonia, Aqua, 26, Carboys	Lb.	.. .15
Ammonia, Aqua, 26, Drums	Lb.	.09¼
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb.	.. — .14
Barium Sulphate (Barytes)	Pre Ton	30.00—35.00
Barium Chloride	Lb.	.04½— .06
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb.	.. — .82
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	.03½ — .04
Borax, crystals	Lb.	.06¾— .07
Boric Acid, powdered	Lb.	.. —.11¼
Bromine (technical)	Lb.	.. — .38
Calcium Carbide, car lots, f.o.b. works	Ton	.. —100.00
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —105.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	.. —110.00
Calcium Chloride, fused	Per Ton	36.00—38.00

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TABLE OF CONTENTS

EDITORIALS:

Page

- A Dividend For Science ... 76
- Annual Meetings—Ottawa ... 76
- Collaboration ... 77
- Words, Words, Words ... 77

Health Considerations in Industries Using Chemicals and Chemical Processes ... 78

Annual Meeting, Canadian Institute of Mining and Metallurgy, Ottawa, March, 1922 ... 79

W. R. Wilson, President of Canadian Institute of Mining and Metallurgy (Sketch) ... 81

On the Metallurgy of Carbonaceous Ores (Abstract of Paper by Andre Dorfman) ... 82

New Method for the Preparation of Pure Ceria Earth Compounds. By Richard H. Manske ... 83

Low Temperature Carbonization ... 84

Nitrogenous Fertilizer and Oil Shales ... 84

Page

Feldspar in the Ottawa District. By N. B. Davis ... 85

Regulations Regarding Use of Alcohol in Proprietary and Pharmaceutical Preparations ... 86

A Visit to the Packers' Hospital, Chicago. By E. A. Alliott ... 87

W. C. Good, M.P. (Sketch) ... 89

Chemical Society News ... 88

World Conditions and News in Chemical Fields ... 91

Mineral Production in Canada, 1921 ... 93

Mining and Metallurgy in British Columbia ... 94

Latest Chemical and Metallurgical Patents. By A. E. MacRae ... 95

The Canadian Aluminum Industry ... 96

Industrial and Business Items ... 96 97

Catalogues Received ... 97

Chemical, Oil, and Metal Markets ... 97

Classified Advertisements 50 Buyers' Guide ... 43

FROM THE PUBLISHERS—

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EDITORIALS

A DIVIDEND FOR SCIENCE

AT the first annual meeting of the "Societe de Chimie Industrielle," held in Paris, last October, Georges Claude, whose work in connection with the liquid air industry is classic, talked on the application of scientific research to industry and the synthesis of ammonia.

Referring to the duties of industrial concerns towards science, he said:—

"And, first of all, I would like to state my opinion quite frankly to those companies which make use of the applications of science (and at the present day they comprise nearly all industrial concerns). No doubt these organizations have laboratories, which, in some cases, are most generously endowed; but they are merely for the satisfaction of their own personal needs. Pure science, which is the origin of all progress, possesses little or no interest for them, nor do they care about the training of research chemists.

"Yet it is undeniable that these companies are to the very highest degree benefitted by the progress of science. No matter how original a process may be, it is the outcome of the general advancement of science and follows, directly or indirectly, from innumerable pieces of work, most of which were disinterested. Thus, these companies benefit to a very considerable extent by work which did not bring a cent to their authors, and then calmly forget all about it. This is a little too convenient!

"Hence, just as it is equitable (and profitable) to have workers participate in profits and to give technicians a share of the progress which they have brought about, so it is but just that a small proportion of the profits should be devoted to helping out laboratories."

Claude here touches upon a very distressing, but important condition of affairs. No one expects or desires that a pampered class of scientists shall be created within any industry or industries, or by the State. At the same time, manufacturers forget to make any real analysis of the path of their progress.

In countries like Canada, the United States, or wherever a quick development of new and rich areas has been undertaken, the fundamental fact that science has made possible this rapid degree of expansion is often forgotten. The scientist himself has been given but little credit, whereas the mentality of lesser calibre is exalted, because he has secured power and wealth through marketing or manufacturing.

What industry has done for science to date has been largely initiated from the most selfish viewpoint. We are reaching the stage where wealthy gentlemen are beginning to seek lasting fame through donations to scientific activities, principally in the field of medicine. We should have a broader return of funds to the seed-beds of science.

Perhaps in this day of taxes, we may yet see a further tax designed to create a fund for the advance of science in the industry concerned. We have passed the stage where there is much argument about the necessity for general public school education; but we have not reached the point where farmers are taxed separately for agricultural research and packing-houses, textile mills, and our various specific industries, for further scientific research, necessary as guarantees to their progress or stability, and the support of the brain-power that leads and drags them forward.

ANNUAL MEETINGS—Ottawa

IT may be definitely stated that the annual meeting of the Canadian Institute of Chemistry, and the Society of Chemical Industry, will be held in Ottawa, from May 15th to 17th.

Ottawa should be remembered as the birthplace of the Institute, as it was here, but four years ago, that preliminary organization was undertaken. The Institute in a very short period has demonstrated its usefulness to the profession, as a medium through which service may be rendered, both to fellow-members and the industries of Canada.

This year, the meetings are being held during the same week as those of the Royal Society, so that a particularly large number of Canadian scientists will be in Ottawa.

Conventions in this country, due to the great distances, cannot be attended every year by all those who would enjoy being present. At the same time, a very special effort should be made, for the very reason that Canadian chemists are scattered. The Canadian Institute of Chemistry is even yet but scarcely out of the period of organization, and it requires the individual interest of each and every qualified chemist to make it a complete success. As for the Society of Chemical Industry, there is urgent need for an active Canadian council to handle local national problems.

If it be true that there is not as yet much weight attached to the public deliberations of chemists, is it likely that there will be more in future, if each member of these societies is content to miss opportunities for the collective guidance of industrial affairs?

Already a good program may be promised all those who can possibly be in Ottawa on the above dates. As ever, the future must be planned for, and stock taken of our present position. Plan now to meet old friends and become better acquainted with those in your own business and profession who need these annual opportunities for rejuvenation quite as much as you do.

COLLABORATION

ANY chemist who has had the misfortune, or otherwise, to appear in the witness box after a conference with the lawyers of one party to a case, can readily recall what a different aspect is put upon matters by the opposing counsel in cross examination. That is the result of approach from a different angle.

One of the interesting phases of a recent address by Dr. Mees, in the course of which he touched on the theory of exposure to light of sensitive films, was that he had placed the matter before his colleague, Dr. Silverstein, and the result of their exchange of views was the evolution of a distinctly new conception of the action of light.

The greatest disasters in administration of national affairs have followed in the train of one-man domination, just as the single track is the most inefficient form of rail transport

One of the notable advantages that might be expected to accrue from the establishment of research laboratories is that of the complementary mentality of a staff of specially trained investigators, but even they may get into ruts. Hence the advisability of locating these institutions at a University centre where there will be the coming and going, not only of leading scientists, but thinkers in other lines of progress whose mutual mental reactions will prevent stagnation. Furthermore, there will be an added source of stimulation to the student body, which would be lacking if such an institution were located merely at the centre of government.

THE OPINION OF A FEW

THE plan of relying on the government for industrial research has been seriously questioned by some who have had experience in such matters. If in Canada, we do a foolish thing by placing all research activities of the Government at Ottawa, even for a time, and, for political reasons leave the perfectly good facilities of some of our universities and industrial centres in neglect, is there any guarantee that our centralized activities will be free from the cluttering and retarding influences of the spoils system?

Are we not yet advanced sufficiently to make several right moves simultaneously?

It is a scathing rebuke to our national intelligence to find that, even in the matter of advancing the very foundations of our country's wealth, by the application of tried and proven methods of scientific development, there is an inert body resting in power, which, either from sheer lack of vision does not comprehend, or which, from a preconceived idea of the slowness of this method of securing self-glorifying results, lacks the courage to do more than apply ointment, where a major operation is the proper diagnosis.

WORDS, WORDS, WORDS

THE student to-day has so much reading to do that prolixity should be regarded in the light of a misdemeanor.

Here is a paragraph from a recently published industrial treatise.

"Almost all vegetable structures contain cellulose IN SOME FORM, AND TO SOME EXTENT AND consequently a great variety of materials have been suggested FROM TIME TO TIME as raw materials for paper. It is not possible IN THIS BOOK to deal with all these MATERIALS, and attention will be directed only to those that are the basis of large ACTUAL manufacturing operations. It should not be inferred, however, that study and research concerning new materials for paper is not worthy of constant attention, as it indeed is, owing to the strain the modern demand for paper is putting on the ORDINARY PRESENT-DAY sources of pulp."

There are one hundred and six words in that paragraph and of that number, twenty which we put in small capitals are redundant, a shade under nineteen per cent. The book contains 591 pages, excluding index, which could not be described as redundant. The writer's style is similar throughout, so that elimination of excess words might be expected to lead to a saving of from one hundred to one hundred and twenty pages of about 600 words per page, or about sixty thousand words.

This constitutes a gross waste of time, paper and labour for composition before it gets to the student who loses more time.

Examination of the paragraph reveals a sloppy use of English, with confusion of plural and singular, and one instance where the writer falls into the trap of a double negative, which has the effect of stating that research is not worthy of attention.

This kind of writing is all too frequently met with in treatises on subjects involving the application of engineering and chemistry to industry. Its effect is to take the life out of what would otherwise be intensely interesting reading matter. It is another case wherein fine birds suffer from paucity of plumage.

Remember the annual meetings at Ottawa, May 15th-17th. Every chemist should be there. Let's go!

THE HEALTH OF WORKMEN USING CHEMICALS

On this page, we publish a short, but helpful article from the Division of Industrial Hygiene of the Ontario Provincial Board of Health. This division is alive to the possibilities of helping manufacturers and chemists to guard the general health of workmen in special employment. Most industries using or making chemicals have health hazards to some degree, and the new work which the Ontario Government is undertaking should be most beneficial. It implies co-operation, and we trust that chemists and manufacturers will allow the officers of the Government, who are well qualified, to offer suggestions on their general and specific problems. Health is after all the really important thing in life, and working conditions including the nature of the employment are limiting factors. By co-operating and furnishing data to the Government, much can be done to dispel the general belief that many occupations are more hazardous than they really are.

HEALTH CONSIDERATIONS IN INDUSTRIES USING CHEMICALS AND CHEMICAL PROCESSES.

THERE is one fact which every employer whose plant includes chemical-processes and who is concerned with improvement of such processes should always keep in mind. He should never forget that from the nature of chemical substances new combinations may have new effects on the workers and possibly very dangerous ones. There are some chemicals perfectly harmless in themselves, which combined, may be dangerous, even to the extent of causing fatal injuries. Others which the employer knows to be dangerous and is armed with precautions against, are changed by mixture with another chemical so that his precautions are useless, and different ones should be applied.

Roughly speaking, the variable effects of mixed poisons depend on several very elementary factors:

(1) Mixture of two substances may yield a new chemical body.

(2) The solubility of one substance and therefore its power of causing poisoning may be modified by addition of another.

(3) The permeability of the cell membranes of the body to one substance may be affected by the addition of another.

(4) The cell of the body as the result of saturation by one substance may become more easily absorptive of another.

The Practical Bearing of This.

It is not argued that because of their dangers new chemical processes should be prohibited and industrial progress checked. New and better processes enabling either better or cheaper products to be manufactured are a sign of the vitality of industry and make for prosperity. The important point is that the health aspect should be borne in mind and that those engaged in industry should make the fullest use of existing medical knowledge for safeguarding the health of workers. On the medical side it is essential that medical science should keep pace with industrial invention and that all new developments should be studied from the point of view of their health hazards and the preventive measures.

General Principles of Health Protection.

Two things are important. In the first place employers should see that they are taking the best precautions possible against the known dangers of their processes. This means one the one hand making provision for precautions, whether in the way of exhaust ventilation, or protective clothing, or other means, and, on the other hand, making certain that the workers know their danger, how to protect themselves, and—a more difficult matter—that they use this knowledge.

In the second place, where new combinations of chemical substances are introduced those responsible should be on the lookout for poisonous effects on the workers. Slight symptoms should be noted and the best advice secured to discover what is causing the trouble and what preventive measures should be taken.

Workers with chemical materials are subject to many serious diseases. They may acquire eye and skin lesions, circulatory and nervous diseases, acute gastro-intestinal ailments. German figures for 1905 show that 88 per cent. of chemical workers suffered in one way or another and had an average incapacity for work of eight days per man.

Assistance Offered by the Division of Industrial Hygiene.

For Ontario the Division of Industrial Hygiene of the Provincial Board of Health is in a position to assist those interested to investigate the possible health hazard to workers involved in the use of proposed new chemical processes, where these are likely to be adopted at all extensively or where many individuals are exposed. The investigation would be conducted with a view to testing possible dangers and discovering measures of prevention.

The logical time for such investigation would obviously be before machinery and other necessary equipment had been generally installed and before cases of illness had occurred. The aim should be to study and relieve conditions before they become chronic There may be many men in various factories who are apparently quite healthy, but who over a period of years will show signs of the nature of their occupations. These slowly acting conditions are of as much value from an efficiency standpoint as some of the very startling cases where employes are overcome at their work or show specific diseases in a few months.

PUTTING IT UP TO THE CHEMIST.

On March 14, some 20 pilots, along with officers of the Marine Department, discussed the difficulties of navigation in the St. Lawrence, at Three Rivers, due, it was claimed, to mist and fog, created by fumes from pulp and paper mills. Under certain wind conditions, the fog produced from these fumes made safe navigation almost impossible. Representatives of the paper companies agreed to put the solution of the difficulty up to their chemists, and no doubt the pilots will note some relief shortly.

PURIFICATION OF COPPER SULPHATE SOLUTIONS.

At the Pacific Station of the United States Bureau of Mines, Berkeley, Calif., in the study of the purification of copper sulphate solutions, it has been proved quite definitely that some active form of oxygen is formed when ferrous sulphate solutions are blown with air in the presence of suspended finely divided lime-rock. In solutions containing both ferric iron and aluminum under the same conditions, the calcium carbonate is converted into almost pure calcium sulphate containing hardly any iron or aluminum, the latter forming colloidal hydroxide, very deep brown and quite clear in solution.

Annual Meeting, Canadian Institute of Mining and Metallurgy

Valuable Technical Papers Feature Ottawa Meeting, March 1st-3rd

A PARTICULARLY fine series of papers was presented at the annual meeting of the Canadian Institute of Mining and Metallurgy, held this year in Ottawa, from March 1st to 3rd. Meetings were held in the lecture hall of the Royal Victoria Museum, and opened with Mr. C. V. Corless, the President, presiding. The first business was a consideration of mineral statistics, as presented by Dominion and Provincial representatives. Mr. S. J. Cook, representing the Dominion Government, gave an interesting account of the co-operative plans by which the Provinces and the Dominion gather the material. All the Government departments concerned are to be congratulated upon the co-operation shown and the work done in preparing printed reports of very fair accuracy so early in the year. Ontario was represented by Mr. T. W. Gibson and Mr. W. R. Rogers; Quebec by Mr. T. C. Denis; and British Columbia by Mr. J. D. MacKenzie, who read the report of Mr. W. Fleet Robertson. The falling-off in production was very considerable, when compared with 1920, but a very bright feature of the situation was the increase in gold production. On the same basis of valuation, total mineral production in Canada, including non-metallics, dropped from $237,422,857 in 1920, to $172,327,580 in 1921. The gold increase for the Dominion went from 765,007 oz., in 1920, to 924,374 oz. in 1921, and from Ontario reports, it is certain they will be greatly increased in 1922.

During the convention, visits were made by members to the Parliament Buildings, the Royal Mint, and the Refining Plant of the British America Nickel Co. On Saturday, the 4th, members were the guests of the Kingdon Mining and Smelting Co., who operate a lead smelter at Galetta, Ont. The annual dinner was held at the Chateau on Tuesday evening, with Mr. J. A. Dresser as Chairman.

Among the papers of general interest was one by Dr. Adam Shortt. He spoke on matters relating to currency and the gold basis of money. He pointed out that, within limits, gold was a good basis of exchange, but that, whenever events made the exchange of commodities between nations most unequal, gold ceased to function as an exchange corrective. As conditions become normal, gold producers should become even more prosperous.

The principal papers presented were:—

1. "The Economic Relations of Canadian Gold Production," by Dr. Adam Shortt.
2. "The Relationships of the Mining Industry to the Canadian Railway Problem," by Chas. Camsell.
3. "The Mining and Milling of Gold Ores," by the Staff of the Hollinger Consolidated Gold Mines, Ltd.
4. "Institute Policy," by G. C. Mackenzie.
5. "The Probabilities of Stable Gold Production in Northern Manitoba," by J. P. Gordon.
6. "Possibilities of Placer Mining in Cariboo District," by W. A. Johnston.
7. "Recovery of Precious Metals from Sudbury Nickel Ores," by R. L. Peek.
8. "Ontario Gold Deposits, Their Character, Distribution and Productiveness," by P. E. Hopkins.
9. "Mining and Milling McIntyre-Porcupine Gold Ore."
10. "Ball Paths in Tube Mills," H. E. T. Haultain and F. C. Dyer.
11. "Feldspar in the Ottawa District," by N. B. Davis.
12. "Possibility of the Use of Sea-Planes in Preliminary Mapping of Pre-Cambrian Areas," by E. L. Bruce.
13. "Presidential Address of C. V. Corless on the Mining Industry in Canada and Its Future Outlook."

At the annual dinner, it was announced that Mr. W. R. Wilson, President of the Crow's Nest Pass Coal Co., Ltd., of Fernie, B.C., had been elected President of the Institute for 1922.

Abstracts of Some Papers.

One of the most important scientific papers presented was that on the Movements of Balls in Ball Mills, by Prof. Haultain, of the University of Toronto. With the greatest care and trouble, he and his students, aided by Mr. Clifford Sifton, Jr., of Filmcraft Industries, Ltd., were able to take moving pictures of working conditions. It was found that previous ideas, as expressed by leading writers, were not duplicated in practice, and several new factors were obviously made visible in the pictures. This contribution is one of the most important yet made, to applied science, by the motion picture method of attack. Evidence of the paths of particles of different sizes at different speeds could not have been more conclusive.

The Mining Industry and Railway Tonnage.

A study of statistics covering total tonnage carried by railways in a number of countries for the year 1919 (the latest year for which complete statistics are obtainable), shows that products of the mine comprised in Canada 35.4 per cent. of the total tonnage hauled, in the United States 50.95 per cent., in India 45.6 per cent., in the United Kingdom 76.8 per cent., in China 51.8 per cent., in Tasmania 27.0 per cent., in New South Wales 54.8 per cent., and in New Zealand 22.8 per cent. The percentages of products of agriculture hauled during the same period were as follows: In Canada 17.2 per cent., in the United States 11.20 per cent., in India 39.7 per cent., in China 20.0 per cent., in Tasmania 23.7 per cent., in New South Wales 18.6 per cent., and in New Zealand, 8.5 per cent.

Under "products of the mine" are included minerals as they come from the mine, quarry, etc., and their immediately recoverable products, e.g., coal and coke; ores and concentrates; stone, sand, and gravel; crude petroleum; and other products such as gypsum, feldspar, salt, etc.

In the United States one freight car out of every three carries coal; but excluding coal, the mining industry in that country furnished in 1919 twice as much tonnage as agriculture, three times as much as forestry, and twelve times as much as the animal industry. In Canada in 1919 coal and coke contributed about 24 per cent. of the total tonnage carried by the railways; but the mining industry in that year furnished in addition in the raw and partly manufactured products mentioned above about 20 per cent. of the total freight, an amount greater than that furnished by either of the industries of agriculture, forests or animals which contributed 17.2 per cent., 18.4 per cent., and 4.5 per cent., respectively.

When it is considered that the mining industry furnishes to the railways more freight than any other industry, in addition to furnishing the power by which all freight is moved by the railways, it is evident that there needs to be a more thorough appreciation of the interrelationship of the two industries in order that there may be a closer co-operation between them; and also that the public should be educated as to the closeness and the importance of this relationship.

Mining and Milling of Gold at the Hollinger Mine.

The holdings of the company comprise a block of 440 acres in Tisdale Township, Timiskaming County, Ontario. Exploratory and development work was commenced in 1909; milling was started in June, 1912. Steady progress has been made, and at present the average daily capacity is 4,000 tons.

Mining operations are being carried on from three shafts, the main and No. 11 shafts being used for handling men and supplies, the central shaft handling ore and waste. Levels are run at 150 foot intervals and the ore blocked out on each level by a system of cross cuts. The shrinkage system of stoping is used whereby only sufficient ore is drawn to allow drilling operations on the back of the stope, and the stope carried upwards until completed, when the ore is drawn and the stope filled with waste. Underground transportation is by electric locomotive of the trolley and storage battery type, hauling on an average 25 cars per trip.

The treatment of the ore consists of four steps; first, reduction to such a fineness that the precious metal content will be exposed to the action of the extracting solutions; second, extraction of the values by treatment with sodium cyanide solutions; third, separation of the solution containing the values from the solids, from which the valuable content has been extracted; fourth, the recovery of the values from the solution by precipitation and the refining of the precipitate.

The reduction of the ore is accomplished by gyratory crushers, rolls, ball mills, stamps, and tube mills. These reduce the ore to a fineness at which 70 per cent. will pass 200 mesh. The values are extracted by sodium cyanide solution which first comes in contact with the ore in the tube mill circuit. 48.5 per cent. of the values is here dissolved, 45 per cent. in the agitators, and 6.5 per cent. in the concentrate retreatment circuit.

The separation of the solution from the solids is accomplished by a counter-current continuous decantation system of thickeners. This consists of eight rows of four tanks each. The thickened pulp, after being given a wash of barren solution in No. 3 tank, and a water wash in No. 4 tank, was discharged to waste, until recently when a drum type filter was installed to further thicken the decantation tailing. Besides separating the solution from the solids, an extraction of two to three cents per ton is recovered in the decantation plant.

The precious metal values are recovered from the solution by precipitation with zinc dust, the precipitate filtered, fluxed and smelted, producing a base bullion which is further refined to a bullion, 810 fine in gold, 140 fine in silver.

The McIntyre Mine.

The original McIntyre consisted of two forties, and by the acquisition of the adjacent claims, the company now hold a block about Pearl Lake of 360 acres. From a small ten-stamp, amalgamation and concentration mill erected in March, 1912, which was replaced in 1913 by a 150 ton all sliming cyanide plant, the mill was gradually increased to a capacity of 550 tons per day and additional units are being added to bring up the capacity to 800 tons daily.

From the veins on this property two types of ore are obtained, the quartz ores and the sulphide ores. At certain points No. 5 vein is intersected by graphitic or carbonaceous faults, and the ore mined from such areas is contaminated with carbon, requiring a special method of treatment. The mill feed averages around $15.00 per ton.

Mining operations are carried on from two shafts, No. 5 shaft is used for men and material, the main shaft for hoisting ore and waste. The main shaft has been sunk to the 2,000 ft. level, and the No. 5 shaft to 1,375 ft. level. Levels are driven at 125 ft. intervals. The 1,000, 1,375, and 1,850 ft. levels are the main haulage levels, the ore from the other intermediate levels being by-passed to the main haulage levels.

Development work is guided by the use of the diamond drill, long inclined holes being drilled below the lowest working level to obtain information on which to plan future development.

Stoping is carried on under the shrinkage system; the veins being nearly vertical and not of too great a width, the ore bodies can be mined most economically by this system.

Transportation underground is by electric locomotive of the storage battery type, on the main haulage levels. On the intermediate levels hand tramming is the general practice.

A feature of the operations at the Hollinger and McIntyre mines is the excellent safety work being carried on by these companies, to minimize accidents. Each company employs a safety engineer, who inspects all workings daily, and reports to the General Manager and Superintendent of Operations as to his findings, together with his recommendations. The Superintendent's copy is posted up in the shift bosses' office, and must be initialled by each shift boss daily.

In conjunction with this work, safety first literature and bulletins are posted up, and distributed to the employees. The result has been a steady decrease in the number of accidents.

Feldspar in the Ottawa District.

The prosperity of the pottery industry in the United States during the war years created an increased demand for certain raw materials, particularly feldspar. The Canadian production (which has come from the vicinity of Kingston, Perth and Ottawa in Ontario, and of Buckingham in Quebec), varied in 1902 to 1919 from 10,000 to 20,000 tons per year. In 1920 the production increased to about 30,000 tons, valued at approximately $281,000. The 1921 production showed a temporary decrease due to general trade conditions.

The increased demand for feldspar has led to the exhaustion of the commercially accessible deposits in the United States and the largest and purest body known today is the Derry feldspar property, located in Buckingham township, about 22 miles from Ottawa. This is operated by O'Brien & Fowler of Ottawa, Canada.

The deposit was discovered late in 1920 and was put on an operating basis shortly after. Exploitation has shown that of the material handled, 99.5 per cent. is feldspar. This material is of exceptionally high grade and holds a commanding position in the United States market to-day. Practically the entire production is used in the manufacture of high tension electric insulators. There is practically no waste as the quartz recovered is disposed of to the phosphate chemical industry and the "fines" is used in the building trades as a stucco dash on account of the rich buff tone it imparts to the exterior of buildings.

Using the Sea-Plane for Geological Mapping.

The economic possibilities of air locomotion are being extended. Through the kindness of Capt. A. W. Carter, Officer in Charge of the Sioux Lookout Station of the Air Board, Dr. Bruce was permitted to test the use that might be made of the sea-plane in making preliminary geological investigations. After the mapping of the country in the vicinity of Lake St. Joseph for the Ontario Department of Mines in 1921 had been completed, a short flight by sea-plane was made over the area mapped. With the finished map it was possible to check up the observations made from the air.

The results were found to be very satisfactory and the observer is enthusiastic over the possibilities of the sea-plane. From the air it was found possible to recognize the most striking geological formations by their color and by the general surface features that are characteristic of sections of country underlain by different types of rock. It was found possible to distinguish granite from those rocks which are more favorable to the occurrence of economic minerals and to recognize certain areas as having their bed-rock concealed by surface deposits.

"It seems evident that the use of sea-planes would relieve the geologist of a vast amount of work and would save a large part of his time. Areas of granite which are not important economically, and those areas of deep glacial cover where no rocks are exposed, could be eliminated. It would thus free him for the exploration of the areas of promising rocks, and so extend the field covered by each season's operations. It would, moreover, give him an idea of the most advantageous points for inland traverses and would show him the position of inland lakes which might be of use to him in fixing the boundaries of formations."

W. R. WILSON, PRESIDENT OF THE CANADIAN INSTITUTE OF MINING AND METALLURGY.

Mr. W. R. Wilson has had a most cosmopolitan experience in mining. As a young boy in England, he worked about the coal mines some fifty years ago. His father was an experienced coal miner, and was employed as a specialist on shaft-sinking, and came to Canada for the General Mining Association of London, arriving in Cape Breton with the new President of the Institute, when he was a lad but seventeen years of age. The President's practical experience in Canadian mining affairs dates back some time. Here Wilson Jr. worked as a regular sinker or rock-hand on two coalshafts at Cranberry Head, North Sydney. He returned to England and completed his education, specializing in mining. His first job was in connection with new work, namely the application of composite masonry in shaft lining. This was successful. He then undertook positions in various collieries, becoming under-manager at Cottom. During all this period, he studied and took lectures, securing a First Mine Manager Certificate.

Leaving Silksworth, he went to North Staffordshire to manage the mines of W. Y. Craig. Here under the special difficulties of the seams, nearly every method of mining was used. Here a shaft twenty feet in diameter was successfully sunk through sixty feet of quicksand and secured by sliding tubing in seven days.

From England, Mr. Wilson again came to America, locating at Pittsburg. He designed plants and set out systems of underground operations for the Chartiers Block Coal Co. This work developed into a general consulting business in the coal mining fields of the United States.

In the course of this work, he designed the first steel head frame ever built over a coal shaft in the United States, and designed also the first pendulum counter balance side dump for pit cars.

In 1900, he came to Fernie, B.C., as general manager of the Crow's Nest Pass Coal Co., but, in 1901, went to South Africa, as General Manager of the Veereeniging Estates, Ltd. After three years there, he returned to Toronto, opening an office as consulting engineer. In 1911, he returned to Fernie under Mr. Elias Rogers. Upon the death of Mr. Rogers, two years ago, he became President and General Manager of this Company.

MR. W. R. WILSON,
President-Elect, Canadian Institute of Mining and Metallurgy.

A NEW METHOD FOR MEASURING PRESSURES IN EVACUATED INCANDESCENT LAMPS.

In one of the papers to be presented at the meeting of the American Electrochemical Society, April 27, 28 and 29, Dr. Duncan MacRae, of the Westinghouse Research Laboratory, describes a new method for determining the pressure in a tungsten vacuum lamp. The principle is extremely simple and more accurate than the approximation that has heretofore been made by the well-known use of the induction coil. Dr. MacRae measures the pressures by a McLeod gauge. The measurements on lamps immediately after the process of exhaust (before "flashing"), and after "flashing," as well as on life tested lamps, are given. The operation known as "flashing" consists in lighting the lamp during exhaust in the presence of phosphorus or other chemical substance.

ON THE METALLURGY OF CARBONACEOUS ORES.

A most interesting paper was presented by Andre Dorfman on this subject, at the recent meeting of the Canadian Institute of Mining and Metallurgy, at Ottawa. During the past several years, tests have been made, and research carried on designed to overcome these difficulties. A pulverized sample of this rock, known as graphitic schist, when in contact with a gold cyanide solution, was found to act as a powerful precipitant. This made the cyanide process for these ores impossible and resulted at both the Porcupine Crown and McIntyre mines in the exclusion of much otherwise good milling ore.

It was clearly shown that the amount of gold precipitated from a sodium auro-cyanide solution Na Au $(CN)_2$ by carbonaceous schist was directly proportioned to the quantity of carbon present. The percentage of carbon is not constant in these ores; but the actual relationship was determined to about $2.75 loss for each pound of carbon per ton of ore. About 20% of this gold goes back into solution on continued washing, so that the net permanent loss was slightly more than $2 for each pound of carbon.

Experimentation was carried out on the following lines:

1. Chemical pretreatment of the ore.
2. Chemical aftertreatment of mill talings.
3. Physical methods, vacuum and heat.
4. Flotation concentration.

Chemical Pretreatment.

Nearly everything, including acids, bases and salt solutions, were used without success. Oxidizing agents, such as dichromates, permanganates, were unavailing, and the tests included various double salt cyanides. In the retreatment of tailings, with sodium sulphide, the precipitated gold was not appreciably dissolved.

Physical Tests.

Heating to 300°C. did not assist, and it was evident that nothing short of roasting completely would stop precipitation.

Flotation Tests.

These tests were varied in every way with different oils and machines. The aim was to crush in water and eliminate the carbon (5% to 10%) by flotation. Any gold floating with the carbon could be recovered.

This method has proved most successful. A sample of pure carbonaceous matter with a precipitating power of 22 oz. Au. was pretreated with different grades of crude oil, or its derivatives. The effect of fuel oil on kerosene gave a reduction of 99% of the precipitating properties of the schist. In the case of ore contaminated with much schist, the table below shows the high measure of success obtained.

In mill tests, the oil-pretreatment process has also been successful, and the author quotes a 24-hour test, where $2.60 was extracted from a $3.60 carbonaceous ore.

The ore is crushed in water and pretreated with a mixture of crude fuel and gas oils in the ball mill and tube mill scoops. The amount of oil added in the test run was not closely regulated, but amounted to 0.76 gallons per ton of ore.

The consumption of cyanide was the same as in direct practice and no mechanical difficulties or foaming troubles arose.

"INDUSTRIAL HYDROGEN."

By Hugh S. Taylor,

Chemical Catalog Co., p.p. 203. Price $3.50 (U.S.A.)

The series of books undertaken by the American Chemical Society continues to make progress, and the latest monograph outlines essential chemical facts about the production of hydrogen.

To begin with, the author has had the advantage of the work of several previous careful authors, and a considerable amount of information from individuals and literature which has only recently been available.

We cannot do better in review than outline the method in which the subject is covered. In general, the various methods used in generating hydrogen are treated in separate chapters. These natural divisions involve the production of the gas from steam and iron, water gas and steam,water gas by liquifaction, electrolysis, water, aqueous alkalis, and hydrocarbons. In each case, commercial practice is described with considerable discussion.

One chapter deals with minor, but interesting methods of producing hydrogen and a further chapter covers the purification and testing of hydrogen. An author and subject index makes the book a valuable record.

Books of this type have a specific purpose. Those interested in the commercial production of hydrogen will find that it covers the field in good detail; while the casual reader has available a most complete account of this relatively new chemical industry. The book is fairly well illustrated with practical drawings.

EXTRACTION ON GRAPHITE ORES.

Weight of sample (Grms.)..	90	90	60	60	60	60	60	60	60	60	60
Water added (Grms.)......	300	300	300	300	300	300	300	2610	210	210	210
Fuel oil (c.c.)............	Nil	1.2	Nil	0.2	0.4	0.6	1.2	Nil	1	1	1
Hours of treatment........	Nil	3	3	3	3	3	3	1	1	1	1
NaCN and CaO added, Grams of each..........	0.25	0.25	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Hours of cyanide treatment	43	43	41	38	38	38	38	36	36	3 6	36
Value of solution after agitation, $..............	3.39	4.34	0.16	1.49	1.61	1.61	1.72	2 0.8	0 2.5	2 2.6	8 2.6
Extraction by solution, $...	11.18	14.32	0.80	7.45	8.05	8.05	8.60	2.80	8.82	9.38	9.10
Value of tailings, $........	4.07	0.83	8.86	2.06	2.06	1.86	1.12	6.60	1.20	0.60	0.60
Composite head assay, $...	15.25	15.15	9.66	9.51	10.11	9.91	9.72	9.40	10.02	9.96	9.70
Remarks	Graphitic ore		Strongly graphitic					Strongly graphitic		With approximately 2% Carbonaceous ore	

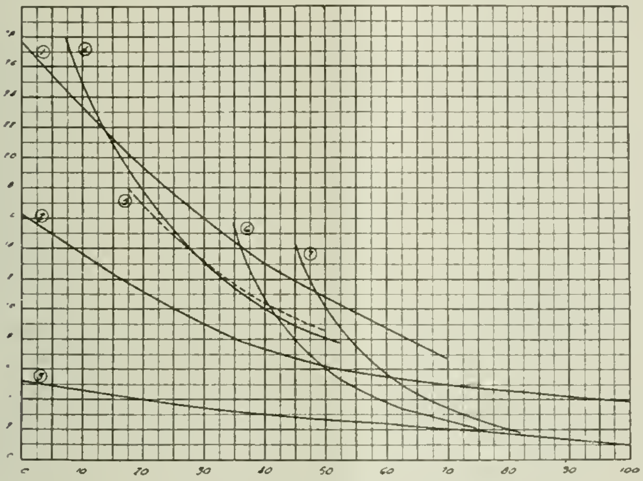
NEW METHOD FOR THE PREPARATION OF PURE CERIA EARTH COMPOUNDS.

By Richard H. F. Manske.

NEARLY all procedures hitherto brought forward for the separation and purification of any or all the rare earths involve a series of fractional crystallizations or precipitations, some so tedious that only several hundred repetitions serve to give a pure product.

In an attempt to find a simple method for obtaining pure ceria[1] earths, the following suggested itself. The process is not entirely new. Mosander and Brauner, among others, have used it, but no one has, to the writer's knowledge, accepted it as successful. The writer could not get access to the original literature on this subject and for that reason is not entirely certain of any originality.

The method adopted depends on the solubility curves shown in the accompanying graph[2]. It will be seen that at 41°C. the three sulphates of cerium have very nearly the same solubility and furthermore at this temperature the solubility of the cerium compounds lies just midway between those of praeseodymium (more soluble) and neodymium (less soluble). Again in the region between 62°C. and 75°C. the two stable sulphates of cerium have a solubility between the solubilities of neodymium and lanthanum.



Solubility Curves of Sulphates to 100 deg. C.

(1) $Pr_2(SO_4)_3 \cdot 8H_2O$
(2) $Nd_2(SO_4)_3 \cdot 8H_2O$
(3) $La_2(SO_4)_3 \cdot 9H_2O$
(4) $Ce_2(SO_4)_3 \cdot 9H_2O$
(5) $Ce_2(SO_4)_3 \cdot 8H_2O$
(6) $Ce_2(SO_4)_3 \cdot 4H_2O$
(7) $Ce_2(SO_4)_3 \cdot 5H_2O$

As is well known the separation and purification of cerium presents no great difficulties and in most procedures is first removed before the separation of the other earths is attempted. The method under discussion, however, assumes the presence of a large amount (some 50%) of cerium; otherwise it would be a failure. Suppose a solution (saturated at zero)[3] containing all four earths as sulphates is rapidly heated to 41°C. and then vigorously stirred to induce crystallization, it is plain, that only lanthanum and neodymium sulphate which might crystallize out would not be contaminated with praeseodymium (from which they are difficultly separable) but with cerium sulphate (from which they are easily separable) until most of the cerium has been precipitated. Or, if a solution saturated at zero)[3] containing the four salts in solution is heated to 65° C., any lanthanum that would crystallize out would be nearly free from the neo and praeseo-salt as long as any cerium was left in solution.

The procedure is therefore simple. It amounts to fractional crystallization by heating a cold saturated solution to 41°C. until a mother liquor is obtained that does not show the absorption spectrum of neodymium in thick concentrated layers. The cerium is separated[4] from this mother liquor and the pure praeseodymium precipitated by oxalic acid in acid solution. The oxalate can be converted into any desirable salt.

Fractionation is continued by this process on the less soluble fractions until the crystals show no absorption spectrum (in concentrated solution) of praeseodymium. Ten fractions serve to give a very pure product, that is, free from praeseodymium.

This last fraction is now dissolved in ice water to saturation and rapidly heated to 65°C. and then vigorously stirred. The mother liquor is nearly free from lanthanum when the neodymium begins to show in the residue in large amounts. Fractionation is, however, continued until the arc spectrum of lanthanum ceases to show in the mother liquor. The latter then contains pure neodymium with some cerium. From this the neodymium is easily obtained.

Fractionation is continued with the less soluble fractions until the absorption spectrum of neodymium ceases to show in a saturated solution of the less soluble fractions. From this the lanthanum is obtained by separation from cerium.

If samarium is present it divides itself between the neo and praeseo-salts. It is therefore best to remove it (before fractionation as sulphate) by fractionation as the double magnesium nitrate as suggested by Drossbach. This also serves to remove any europium and gadolinium that might be present.

[In conclusion the writer wishes to say that this method has not been entirely worked out experimentally but at present experiments at Queen's University seem to more than fulfil expectations. As far as the writer is aware the above procedure has never been used. Any information given to the journal or the writer bearing on this subject will be appreciated.]

Queen's University.
February, 1922.

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[1] The Ceria earths include—Cerium, lanthanum, neodymium, praeseodymium and samarium.

[2] The ordinates express the solubility in 1/1000 moles per litre. The abscissa express the temperature in degrees centigrade.

[3] The solubility of all the sulphates is greater at 0° C. than at higher temperatures.

[4] Any standard book on the subject will give reliable information on the separation of cerium.

A POSSIBLE FERTILIZER MATERIAL.

Germany has been doing some experimental work with magnesium sulphate as a fertilizer. As one of the components of chlorophyll is organic magnesium, as established by Willstatter in 1907, it is possible that magnesium is closely connected with the photosynthesis of carbohydrates. As much crude potash has contained magnesium, some of its good effect may have been due to this factor. Some scientific work has been done on potatoes with the result that the sulphate has been shown to be the best of the magnesia salts, and under some conditions distinctly better yields have been obtained by additions of this salt. Canada has large reserves of natural magnesium sulphate and it is a relatively cheap product to manufacture, so that it would be in order for our departments of agriculture to make a scientific study of magnesium salts and their value to Canadian crops on some of our typical soils.

LOW-TEMPERATURE CARBONIZATION.

The Sutcliffe-Speakman process depends on the fact that if coal is powdered and mixed with about 20-25 per cent. powdered coke breeze the mixture can be briquetted without the aid of a binder, and the briquettes can then be carbonized at any temperature without expansion, so that no special retort is necessary. Further, no matter how high the temperature of carbonization the residual fuel, even when containing less than 2 per cent. volatile matter, burns readily in the open fire like coal, and has none of the practical disadvantages of coke.

The coal used is first washed, ground to a fairly fine powder (depending on the nature of the fuel required), and mixed with the powdered coke breeze. If, for example, the coal and coke mixture is ground to, say, 30 or 40 mesh, the resulting fuel is of an extremely fine grain, and is, in fact, an artificial anthracite. The mixture is then passed through an ovoid press of special design, and the briquettes produced are so hard that they can be charged into a gas retort without fracture.

Briquetting.

These briquettes may then be carbonized at any temperature, and one of the great advantages claimed is that the existing gas-works retorts can be used without difficulty, so that the expense of carrying out the process would be very little in an ordinary gas-works. If, however, a special plant is built, then single retorts have been designed that will carbonize 250 tons of coal a day, and another of the advantages claimed for this process is that such large quantities of material can be handled, because of the non-expansion of the briquettes when carbonized. The temperature of carbonization recommended is very high, much over 1,500 degrees Fahrenheit, and the process is, therefore, strictly speaking, not a low temperature one, but rather a high-temperature operation entirely different from the existing high-temperature processes of the gas-works and the coke oven. As already stated, however, any temperature can be used, since the briquettes give no trouble in carbonizing.

The residual fuel has only about 2 per cent. of volatile matter left in it, whilst the yield of gas per ton of coal is stated to be about 10,000 cubic feet of standard 550 B.Th.U. quality and the liquid products 20-25 gallons, whilst the sulphate of ammonia yield is particularly high, about 35-40-lb., a very large percentage of the nitrogen in the coal being converted to ammonia because of the porous character of the briquettes.

The residual fuel is of remarkable quality, with a close fine grain resembling charcoal, and equal in hardness to anthracite. It is, of course, smokeless, because of the almost complete absence of volatile matter, and it seems to possess, also, many of the properties of charcoal, being ignited readily in an ordinary grate, and burning right through to the centre with a high emission of radiant heat. It is claimed, also, to be a perfect substitute for anthracite in closed stoves.

Low Costs.

The cost of working the process in the ordinary gas-works is given as 5s. per ton of coal carbonized, made up of labor 9d., power 2s. 3d., wear and tear on plant 1s. 3d., and interest and depreciation 9d.

A coal-drying, grinding, and briquetting plant to handle 100 tons of coal in 24 hours is stated to cost £10,000, and the power required is 150 horse-power. This process originated with Messrs. Pure Coal Briquettes, Limited, a company formed by the late Lord Rhondda, and has as its constructional and consulting engineers Messrs. Sutcliffe, Speakman, and Co., Ltd., Leigh, Lancashire. The development of this company and the research work in connection with it are under the charge of Mr. E. R. Sutcliffe, managing director of Messrs. Sutcliffe, Speakman and Co., and Mr. Edgar Evans, formerly head of the Lord Rhondda Research Laboratories, Llwynypia, Glamorganshire.

NITROGENOUS FERTILIZER AND OIL SHALES

One of the most important by-products of those Canadian industries, which now exist or are likely to be established in time, is sulphate of ammonia. With the exception of Chile salt petre, that is to say sodium nitrate, this is the form of nitrogen most generally used as a fertilizer. Its production in Canada depends entirely on the amount of coke which is manufactured whether in the iron and steel industry or in gas works. In the former case this valuable by-product depends on the proportion of recovery ovens used as compared with beehive or non-recovery ovens. The wasteful beehive, so called from the shape and not from its economical quality, turns out no by-products. This yearly waste is being checked by the installation of by-product ovens in place of the extravagant beehive.

The demand for sulphate of ammonia in Canada is no criterion of its importance elsewhere. The fertilizer industry in Canada is at present not on a large scle. Freight rates, distance, and in some cases special local supplies make nitrogenous material other than sulphate of ammonia more convenient for use. Most of the sulphate of ammonia now produced in Canada is an article of export chiefly to British Guiana, the United States and the plantations of the West Indies and Hawaii. The supply is not likely to equal the demand. A time will come, as population increases and fertile prairie soils, however slowly, are depleted of nitrogen, when this necessity for plant food will depend more and more on three or four great sources of the world supply, namely Chile nitrate, sulphate of ammonia by-product, atmospheric nitrogen and cyanamid. At any time war may stop the supply from Chile or a revolution may interfere with its production, and in that case Canada may be forced to have recourse either to costly installation of synthetic ammonia plants or to a source of ammonia at present untouched. Nitrogen is a first necessity in war for explosives, and also in peace for agricultural produce.

A realization of conditions such as these made it necessary for the United Kingdom to take stock of her supplies, and resulted in the Report of the Nitrogen Products Committee published in 1920. In this report every possible source of nitrogen, big or little is examined in detail. Almost all, if not all, of these resources are available in Canada, though often in minute proportions, but there is one source which figures third in the resources of the United Kingdom which is absolutely untouched in Canada as a source of ammonia nitrogen.

The 1,555 gas works in the United Kingdom produced in 1917, from 235,297 million cubic feet of gas, 188,478 long tons of ammonium sulphate (24.5 per cent. NH_3). The next largest supply of nitrogen, 166,354 tons, came from coke-oven works. The third largest was that to which we call especial attention, 50,560 tons from oil shales as a by-product. The lowest price for ammonium sulphate on record in the United Kingdom was $35 a ton in 1897; the average of 1911-1913 was $65. During the war the control price was fixed at $80 per ton.

The constancy of sulphate of ammonia as a by-product of oil shale in Scotland is best illustrated by the figures available for the series of years 1911-1917. In these seven years the amounts produced vary only between 58,000 tons and 63,000, the lowest figure being in a war year. The average amount of shale distilled was 3,000,000 tons a year.

The yield of sulphate of ammonia varies with the different seams or parts of the same seam; some seams yield 70 pounds per ton, others only 30 pounds.

Feldspar in the Ottawa District*

By N. B. DAVIS

OVER the period of the Great War the pottery industry of the United States enjoyed considerable expansion, which led to an increased demand for raw materials, particularly feldspar.

Ontario had been producing from ten to twenty thousand tons annually for a number of years, until 1920, when the increased demand in the United States called for the production of some 38,000 tons—almost double that of any previous year. This rate of production lasted well into 1921, but eventually the general trade depression had its effect, and resulted in the closing down of all but the highest grade quarries. The quantity and value of the output for the past thirty years is shown in the following table:

	Production			Production	
Year	Tons	Value	Year	Tons	Value
1890	700	$ 3,500	1906	16,948	$40,890
1891	685	3,425	1907	12.584	29,819
1892	175	525	1908	7,877	21,099
1893	575	4,525	1909	12,783	40,383
1894	...	.....	1910	15,809	47,667
1895	...	.....	1911	17,723	51,939
1896	972	2,583	1912	13,733	30,916
1897	1,400	3,290	1913	16,790	60,795
1898	2,500	6,250	1914	18,790	70,824
1899	3,000	6,000	1915	15,455	59,124
1900	318	1,112	1916	19,488	71,407
1901	5,350	10,700	1917	11,493	54,555
1902	7,560	15,152	1918	20,232	117,379
1903	13,928	18,966	1919	14,679	86,231
1904	11,083	22,166	1920	37,873	280,895
1905	11,700	23,400	1921 (6 mos.)	16,216	102,160

(Compiled from Dept. of Mines and Dominion Bureau Statistics).

The increased demand encouraged prospecting, and as a result, most of the promising pre-Cambrian areas of Ontario and Quebec received attention.

In the early '90's the feldspar produced in Canada came from the country to the immediate north of Ottawa in the township of Templeton, but with the discovery and opening up of the Richardson mine at Verona, with its cheaper freight rates and operating conditions, the Templeton quarries were abandoned. About 1908 one of the Templeton quarries was re-opened and worked for several years in a small way, but as the mineral lowered in grade the property was subsequently closed down again. There were no further definite developments in the Ottawa district until the autumn of 1918, when work was started opening up two deposits in the vicinity of South March, Ontario, about 15 miles west of Ottawa. This property was developed during 1918-19, but eventually closed down because of the car shortage.

For a number of years the highest grade feldspar on the market, supplied to the dental trade, came from the country north of Buckingham, Quebec. In this territory the feldspars are generally lighter in color than those to the south-west, and vary from cream to pure white. They are distinctively high in potash and low in soda. Transportation charges appeared to make them too costly for the ordinary ceramic trade, particularly when the deposits were considered small and capable of producing no large tonnage.

In the autumn of 1920 the largest and purest body of feldspar known on the continent to-day was discovered in the hills above the Lievre River, about nine miles from Buckingham. This property was taken over by O'Brien & Fowler, and the development carried out during the past year has more than realized the original estimates of the quantity available. This deposit will be described later in more detail.

Fair sized pockets of feldspar are also being worked on the east half of lot 14, range XII, Buckingham township, and another on lot 9, range II, Derry township.

A number of prospects have been opened up on the Gatineau branch of the Canadian Pacific Railway, and a fair amount of white feldspar of soap grade was produced in the vicinity of Mark's Station, Que. Freight rates on this branch line are exceedingly high and operate very much against the development of feldspar deposits.

Mode of Occurrence.

Feldspar as a commercial mineral occurs in extremely coarse grained pegmatite intrusions, generally in the form of dikes more or less lens-like in shape. The dikes do not consist wholly of good material, but segregations of coarse crystals within the mass are of importance. Where the pegmatites are twenty feet or more wide and cut hard rocks, such as gneisses, syenites, etc., the crystallization has a tendency to be extremely coarse, but when limestone is the enclosing rock the crystallization is more or less fine in grain, the rock has a sugary appearance, and there is no coarse separation of feldspar and quartz.

The feldspars of commerce are really intergrowths of potash and soda varieties, with alkali content ranging from 13.5% potash and 1.5% soda, through 50-50 mixtures, such as 6½% potash and 6% soda, over to 3½ potash and 10½% soda.

In the Ottawa district the prevailing type is high in potash, and in these deposits the high-soda spar is found only as scattered crystals near the walls, with the principal iron-bearing impurities associated with the soda spar. In the majority of deposits the quartz runs from 25-50% with other impurities in smaller amounts. Probably 80% of the known dikes contain quartz so intimately associated with the feldspar that the two can not be separated, and although this mixture is practically equal to the material produced by the majority of quarries in the United States, it can not be handled from this territory because of the high freight rates.

The Derry Feldspar Quarry.

The most outstanding deposit of feldspar in the district is that known as the Derry quarry located on lot 8 in the 1st concession of Derry township, Labelle Co., Que., some nine miles north of Buckingham town, and two miles from the Lievre River.

The deposit is part of a large intrusive mass of pegmatite that can be traced across country for a mile or more with the greatest development of crystallization on the south half of lot 8. Here feldspar differentiation has taken place on a huge scale. Intergrowths of individual crystals 20 to 40 feet long and up to 15 feet in diameter occur. The quartz is present in very subordinate amount, actual tonnages separated indicating only 0.5%—a most remarkable record when compared with the ordinary run of deposits. The outcrop has been stripped and shows a width of 50 feet and a length of 300 feet, maintaining the same general characteristics throughout.

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*Presented at Annual Meeeting, Canadian Institute of Mining and Metallurgy, Ottawa, March, 1922.

Accessory minerals such as tourmaline and mica, are present only in small amounts near the walls, and in the process of mining these wall zones are left and taken down separately for cobbing. The present opening is in the form of a side hill cut, and no hoisting will be necessary for several years.

Great pains are taken to maintain the original purity of the material. The surface six feet are quarried separately to ensure the minimum contamination. Holes are drilled across the face to depths of 8 to 14 feet, and three benches carried forward. Holes are sprung where necessary. Both 40% straight dynamite and ammonia dynamites are used for blasting and sufficient holes are fired at one time by means of a battery to produce several hundred tons of broken rock.

In the pit each man uses a stone fork of 5-8 inch opening for handling the spar, which is loaded into one-ton flat dump cars. One or two men stand at each car inspecting the material as it is loaded, to make sure that no objectionable spar passes the muckers. The cars dump into a bin of 100 ton capacity built on the hillside at the mouth of the pit, and the spar passes as required into waggon boxes or sleighs for transportation direct to Buckingham in winter, or to the river loading station in summer.

At the river, the waggons are dumped into a 50-ton chute for delivery to a 40-ton scow, which carries the material down the river to the siding. The spar is taken off the scow by means of a derrick and loaded into cars or placed in stock on a plank platform. From the time the mineral is loaded out from the quarry to the time it is shipped every effort is made to keep it scrupulously clean. The feldspar is cream or buff colored, although some crystals are white to almost transparent.

The analyses of two samples representative of the shipping grade are as follows:

Silica	65.09	65.80
Alumina	18.85	19.74
Ferric Oxide	0.029	0.031
Lime	0.21	0.11
Soda	2.11	1.74
Potash	13.42	12.32
	99.709	99.741

Practically the entire production is used in the manufacture of high tension insulators.

The quartz is taken out separately and disposed of to the phosphate chemical industry.

The fine material passing half-inch mesh, usually regarded as waste, finds a ready market with the building trades as a stucco dash. It gives a rich buff tone to a building. There is, therefore, practically no waste, a unique condition for a feldspar quarry.

SAME HERE.

Senator Capper—who is said to be in training for the presidency under the auspices of the new farmers' party—says "that farming is the only business left which buys at retail and sells at wholesale." He ought to see the balance sheets of some of our chemical and oil houses, which bought heavily during the War—and haven't sold yet!—"Chemical, Color and Oil Record" (New York).

REGULATIONS REGARDING THE USE OF ALCOHOL IN PROPRIETARY AND PHARMACEUTICAL PREPARATIONS.

New regulations regarding the sale and use of alcohol for pharmaceutical preparations have been issued by the Dominion Government. It is provided that in the case of patent or proprietary medicines the officer delivering the spirit shall see the same mixed on delivery with one or more of the chemicals composing the manufactured product. In view of the proprietary character of such preparations the admixture of more than one chemical with the alcohol will be discretionary with the manufacturer, unless there is reason to suspect fraud, in which event customs and excise officers must report to the department.

In the case of other manufacturers the admixture of the spirit with the drugs or chemicals, must be performed under the personal supervision of the officer in charge.

In respect of pharmaceutical preparations, extracts and essences, the department must be furnished with the formula, and when the spirit is delivered to the manufacturer it must be mixed in the presence of the officer. Manufacturers are allowed to keep two Imperial gallons by weight for filling emergency orders, in filling which it is not necessary that an officer be present to see the mixture.

CHAULMOOGRA OIL AND LEPROSY.

The U. S. Public Health Service has felt it necessary to prevent the too optimistic and extravagant claims recently appearing in the newspapers in regard to the curative effects of chaulmoogra oil derivatives on leprosy. While the use of the oil and of its derivatives has resulted in a considerable number of apparent cures, it is as yet too soon to tell whether these will be permanent.

The ethyl esters of chaulmoogra oil, the use of which has largely supplanted the oil itself, constitute a most valuable agent in the treatment of leprosy. In treating young persons and those in the early stages of the disease the improvement has been rapid and striking; in older persons and older cases it is less so. Of the cases paroled from the leprosy stations in the Hawaiian Islands so far about eight per cent. have relapsed and returned for treatment. This was to be expected; and on the whole the results have been so favorable as to make treatment of the disease hopeful.

PROPOSED REGULATIONS FOR SHIPPING NATURAL GAS GASOLINE.

D. B. Dow, chemical engineer of the United States Bureau of Mines, has completed field work on hazards in the shipping of natural gas gasoline. This work included winter tests on tank cars loaded with this type of gasoline. One standard car and one insulated car were filled with gasoline, and record made of pressures developed within the cars, as well as the temperature range of the atmosphere and gasoline. The proposed regulations submitted by the Bureau of Explosives allow no gasoline to be shipped in standard cars unless the vapor tension of the product is below eight pounds. The present regulation allows gasoline of ten pounds vapor tension to be shipped in standard cars. Several tests were made to determine the loss which might be expected, due to weathering gasoline of ten pounds vapor tension. These tests indicate that the loss will be in the neighborhood of 11 per cent.

A Visit to the Packers' Hospital, Chicago

By E, A, ALLIOTT*

THIS hospital, which has only just been completed, is situated in the neighborhood of the Presbyterian and Cook's Hospitals. It is built on the most efficient and up-to-date system, and embodies the latest American methods of dealing with both surgical and other cases. No one from this side had yet visited the Hospital, and I was fortunate enough to be taken through by one of the doctors, a very eminent brain specialist, who gave me the fullest information possible.

As each patient enters the hospital in the ambulance, a table of convenient height is brought up and the wheeled ambulance bed is run on to it. This is at once taken by a tractor to the elevator, where a surgeon is in attendance, and conducts the preliminiary examination on the way up.

On arrival at the 18th floor, the wheel bed is pushed over onto an endless band which passes through the X-ray department; there being a switch arrangement for those patients requiring medical attention only.

In the X-ray department, the photographic apparatus accompanies the patient, being carried on an overhead rail and the necessary photographs are taken, developed and printed as the patient passes along. The finished prints are attached to the bed with a suitable report. This comprises about the first half of the top floor.

In the second department the band passes through into the preparing room, where the patient is stripped and treated with sprays and disinfectants, and the bulk of the more visible dirt removed. The band then traverses a line of nurses, provided with the necessary swabs and lotions for a more thorough cleansing and disinfecting of the portion to be operated upon. At the end there is a spiral gravity slide on which the patient travels to the operating floor. Here he is first met by a physician who takes the necessary temperature, pulse and heart readings, and from him he passes to the anaesthetist, who administers the necessary dose of chloroform. He then travels to the first surgeon who makes the necessary incision, next to the specialist operating surgeon, who does the more delicate work; then to the instrument man, whose special charge is to see that nothing is left behind inside, and finally to the surgeon whose business it is to stitch up the wound.

It should be pointed out that the instruments are sent up to the doctors on travelling bands freshly sterilized, and ready for use, and are taken off and put on suitable tables by the nurses. Each surgeon travels a few feet with the patient on a short moving platform while he does his work, and then returns to take on the next patient. As he finishes his job he places his instruments on a special gravity chute where they go down to the continuous sterilizer on the floor below. Here they are cleansed, disinfected and packed up again into boxes which pass forward continuously to the supply conveyors.

All dirty swabs and bandages go down special chutes to be washed and sterilized and dried. Then they pass forward again for use as secondary coverings, and after that are burned in the special incinerator which raises the necessary steam to supply the sterilizing apparatus.

After leaving the surgery, the patients are attended by nurses who reclothe them and finally slide them off on to another travelling platform on which the regular hospital beds are ranged. The height of the first conveyor is such that a patient can simply be rolled off on to his permanent bed, and the band is given a slight tilt at the correct point to facilitate this.

These beds are delivered to the elevator which takes them down to the next floor where the patients are stored until the first stage of recovery is reached. They are passed down in this manner, floor by floor, at succeeding stages of convalescence.

In order to intensify the human touch, patients are not known by numbers, but by their Christian names, and the staff go through a special course of mental training to enable them to distinguish one patient from another, and address them correctly from the first moment they enter the hospital.

Everywhere full attention is paid to comfort and convenience. A telephone is provided by each bed, and the proper mixtures etc., are brought at the correct time on a conveyor, and are shot off onto the patient by an adjustable deflector. Magazines and cigars are made available in a similar way on a button being pressed. Thermocouples and electrical devices are attached to the patient, and each of these has duplicate leads, one pair of which is taken to a continuous recording instrument in the main consulting room, while the other is attached to the "Automatic Treatment Apparatus" or Selector. In appearance this is a cross between a jacquard loom and the selector of an automatic telephone installation.

Efficiency Supreme.

At 9 a.m. each day there is a convention of medical men and eminent specialists. The image of each patient in turn is projected on a screen by wireless photography, and with this and the charts before them his fate is decided, to the full satisfaction of the experts, who are not called upon to quit their armchairs. At the end of the consultation the chief psycho-analyst rings the patient up, and informs him in a kindly tone that it is confidently anticipated that his stay in the hospital is likely to be a short one. He is then required to repeat 100 times, over the telephone, in a tone of deepest assurance, the phrase: "I am nearly at the end of all my troubles." It is believed that recovery is much affected by this fostering of a correct mental attitude on the patient's part. In the meantime the secretary is transcribing the instructions of the convention on a special machine. This punches a card with perforations to correspond with the desired treatment, and this is placed in the selecting apparatus previously referred to. This machine not only controls the daily routine and despatch of medicines, etc., but rings bells and turns on lights if the patient shows any unwonted interest, or lack of interest, in life.

At 7 a.m. each day the selector connects up the bath and airing switch, and this standard operation of hospital routine is carried out entirely automatically. A bath is brought up by the side of the bed, and the patient is slid into it by a rotary dumper. Meantime a hot blast airs the bed, and this also serves to dry the patient. Arms come over and straighten the bedclothes, while a device like giant pincers descends, and this on closing, tucks him in.

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*The author of this paper is a distinguished English Chemical Engineer who, after spending a few weeks in America, produced this remarkable contribution to scientific humor.

Minor variations in the patient's condition are also fully provided for. For instance, should he become feverish, the selector causes his bed to move into a refrigerating chamber until his temperature subsides.

The X-ray, and other technical departments have reached a very high order of development. A special section with lead walls, one foot thick, is being hurriedly rushed up to receive a ton of pure metallic radium, to be donated by Henry Ford. He has just called for tenders for a new factory for its manufacture, and has advertised for a staff of 1,000 chemical engineers to run it. In order to make good use of the waste material he proposes to spread it in shallow beds on which vitamines will be reared. For this purpose he is purchasing 1,000 miles of railway track, and 2,000 steam shovels, and anticipates the profits will more than cover the cost of extracting the radium.

Some important operations in the flow sheet have now to be described. At the end of the convalescent stage the patient is again passed to a travelling band which takes him to the dressing room, where his clothes are handed back to him, and thence to the discharge room, where the bill is presented. Should any incipient paralysis of the muscles of the right arm be evident at this juncture, an assistant applies high tension electricity to suitable motor centres, with the result that payment is invariably made without any undue delay, and blockages at this point are avoided.

This Way Out.

The fall of the money into the cash box causes a trap to be released which drops the patient into the despatch department, where an automaton gives him a hearty handshake, while the phonograph wishes him "God Speed" and the best of luck. He is then dumped off the end of the line into a waiting taxicab, which takes him to the Poorhouse.

One patient leaves the end of the recovery line every half minute. Dead patients are shot off the mortuary chute into an incinerator which takes the form of a coke oven installation, at the rate of one every three seconds.

The resultant gas and fuel are fully utilized for the production of light, heat and power; while an admirable tar and ammonia recovery plant has been installed. The byproducts are worked up into synthetic drugs for use in the hospital, and outside. The profits from the external sales pay for the very considerable development work undertaken by the hospital staff.

At this juncture I made some enquiry about the kitchen apparatus, but was suddenly awakened by the sound of the building falling and killing all the patients. It was 7 a.m. and a steam shovel had just started outside my window on the foundation of a new hotel, in which 10,000 people had already booked rooms for the following Saturday week. A medical friend whom I saw during the day advised me that the dream was due to a severe "Fruedian complex" of a peculiar nature, which connected the noise of the shovel with the memories of recent visits to the Ford works, the Presbyterian Hospital, and Armours Packing House. He stated that there was no fear of a recurrence if I moved speedily to a somewhat moister climate.

EXPANSION OF PROVINCIAL PAPER MILLS.

A Port Arthur report states that the Provincial Paper Mills, Ltd., have commenced the construction of additions to their plant at an estimated cost of $1,500,000.

Chemical Society News

MANITOBA CHEMICAL SOCIETY.

The February meeting of the Manitoba Chemical Society was addressed by Mr. C. F. Bodle, who spoke on "X-Rays and Some Applications." After referring to the discovery of the cathode stream, by Sir Wm. Crookes, and to the investigations carried out by Sir J. J. Thomson and Rontgen, Mr. Bodle dealt with the many improvements that have been made with X-rays. In its latest form—the Coolidge tube—an incandescent spiral of tungsten is used as a source of electrons and a tungsten block for the target.

Turning to the application of X-rays, Mr. Bodle spoke of the value of radiographs in surgery, medicine and industry. In the latter they are used for a wide variety of purposes, among which might be mentioned the detection of flaws in rubber goods and in metal castings, in the examination of shells and air-craft timber, and in the treatment of cigar leaf to prevent infestation by insects. Perhaps the most notable application of the X-rays to scientific work has been made by W. H. and W. L. Bragg, who have devised methods of analyzing a beam of X-rays and measuring their wave lengths. They have also used X-rays as a means of determining the arrangements of the atoms in crystals. Continuing, Mr. Bodle referred to Moseleys' experiments, which led to the discovery of the relationship existing between the X-Ray spectrum of an element and its position in the periodic table. An account was also given of two other methods of chemical analysis by X-Rays. In one of these, worked out by Barkla, the unknown substance is placed as an absorbing layer in the path of a beam of X-rays; the spectrum is photographed and the position of the absorption bands determined. In the other, a beam of monochromatic X-rays is passed through a minute quantity of the substance and a photograph is taken of the diffraction pattern so produced.

This interesting and comprehensive paper by Mr. Bodle was illustrated by nearly fifty lantern slides.

A. W. ALCOCK, Secretary.

TORONTO MEETING SOCIETY OF CHEMICAL INDUSTRY.

On March 17th, Prof. W. D. Bancroft, head of the Department of Physical Chemistry at Cornell, presented the Section with a masterly address on some new color work that he has been following up. This work lies on the border-line of physics and chemistry, and demonstrates the possibilities of co-operative research in fields. Colors in feathers—protective colors in fish—colors in thin films and specially-heated glass—the human eye—were a few of the interesting points discussed. Colors of the structural class where no pigment could possibly be present were explained, mainly from the standpoint of effects secured through the presence of minute air bubbles. Prof. Bancroft presented a number of slides, demonstrating his work on feathers. Of particular interest were the pictures illustrating the facilities of flounders to match the color of the surface underneath them.

Previous to the meeting, Prof. Bain stated that the Canadian Institute of Chemistry would arrange for the programme of the next meeting. The members present were unanimous in appointing Dr. L. F. Goodwin, of Queen's University, as the Canadian representative of the Chemical Engineering Group of the Society. Those particularly interested in chemical engineering should correspond with Dr. Goodwin.

THE CONSTRUCTIVE CHEMIST.

Dr. E. E. Slosson, Director of Science Service, Washington, D.C., and a well known American Chemist, addressed the Royal Canadian Institute, Toronto, March 11th, on "The Constructive Chemist." Dr. Slosson's address proved one of the most interesting given at the Institute and was very favorably reported and commented upon in the daily press. The part that the chemist must play in the renewal of the world's supply of food and fuel was dwelt on by the speaker. Such a programme on the part of the chemist was a constructive one and one that demanded considerable research, but it should be the great work before all chemists, and indeed world conditions were fast forcing the chemist to take up this programme whether he wished it or not.

If the world's work had to be accomplished through the agency of actual horse power, he said, the world could not grow hay enough to feed the number of horses that would be required to produce the "horse-power" required to-day.

The iron horse had taken the place of the long since past, faithful transport horse, but the iron steed fed on the crops of the carboniferous age, and our coal deposits were being rapidly used up and would eventually be completely consumed. Similarly the world's gasoline tank was running low and the present supply in the United States, according to experts, would be entirely depleted in twenty years.

To Dr. Slosson's way of thinking, there were only two possible solutions for the shortage of fuel which must result when present supplies have been exhausted. One of these was the discovery by the chemist of some means of fixing the radiant energy of the sun. The other was the liberation and utilization of the forces within the atom. It was on the former that the speaker placed most reliance, and he was hopeful that the problem would one day be solved.

At present, however, every blade of grass, flaunted scorn in the face of the chemist, for it could do what he could not—combine hwdrogen, oxygen and carbon into those life-giving substances which are the basis of the world's food and fuel.

Exemplifying the power that lies untapped in the sun's rays, the speaker pointed out that forty square miles of the Arizona absorbed as much heat in six hours as was produced by all the coal burned in the world in twenty-four hours.

Dr. Slosson concluded his address by referring to some of the marvellous advances made in the science of chemistry in recent years, this progress being well illustrated in many industrial fields.

PERSONAL.

J. L. McNichol, who was assistant Paper Controller, has taken a position with the Government of Siam, at Bangkok. He will undertake semi-commercial work on natural products, such as grass, bamboo and rice straw. Mr. McNichol has had twelve years experience in the paper industry.

W. C. GOOD, M.P.

The Province of Ontario has recently announced the appointment of W. C. Good, M.P., of the College Class of '00, to the Board of Governors of the University of Toronto.

Mr. Good happens to be a graduate in chemistry of that year, and as such becomes a natural representative of chemists in the Ottawa House. Following his work at the University of Toronto, he went to Guelph, where he was on the staff of the Ontario Agricultural College for two years. He then returned to his farm near Brantford, where he has since made practical farming his profession. He was elected on the Progressive ticket and, along with Mr. Joe Harris, of Toronto, makes at least a pair of members who took chemistry as a major subject during their University course.

W. C. GOOD, M.P.

CONVENTION PLANS.

The Annual Meetings of the Canadian Institute of Chemistry and the Society of Chemical Industry will be held in Ottawa on May 15, 16 and 17. For the remainder of the week, the Royal Society will hold meetings. Already plans are under way for a large attendance.

UNITED STATES CHEMICAL EXPORTS.

While the exports of chemicals from the United States fell off in value greatly during 1921, yet when compared with pre-war years the business done last year was not so bad after all. In 1920 exports of chemical products from the United States were valued at $168,999,706, and dropped last year (1921) to $61,111,293. In 1914 chemical and dye exports were valued at $27,079,092, while in 1908 they were only $20,873,155.

OTTAWA SECTION, SOCIETY OF CHEMICAL INDUSTRY.

The regular meeting for March was held at the University Club, March 10th, with Mr. F. J. Hambly in the chair. The minutes of the previous meeting were read and approved. Dr. Shutt questioned the Chairman regarding the extent of the publicity being given to the meetings of the Ottawa Section, and the Secretary said that notices had been sent forward to the Journal of the Society, but that these had not been forwarded regularly and as a consequence the General Secretary of the Society had not really had a very good opportunity to use the material sent.

Mr. Hambly introduced Dr. J. A. McRae, of Queen's University, the speaker of the evening, and said that Dr. McRae would speak to the members regarding some work which he had carried on during the past two years in Manchester. Dr. McRae, on being introduced, said that the work which he had done in Manchester had been under the direction of, and in co-operation with, Professor Lapworth, of Manchester University, and the research had been carried out with a view to prepare from succinic acid, derivatives which might prove to be the source of useful commercial dye stuffs. He intimated that what he had to say before the members of the Society could not in any way be regarded as a paper on the subject since Professor Lapworth's thesis would be published shortly and would appear in the journals of the Chemical Society. His remarks would, therefore, be of an informal character, and would refer only to the general principles involved in the addition of hydrogen cyanide to organic compounds. Proceeding then from simple examples, Dr. McRae led his audience for an hour through the intricacies of organic formulae in a way which was readily followed by everyone present. At the conclusion of the address, Mr. Hambly congratulated Dr. McRae on the able way in which he had taken his hearers from the knowledge of their student days down to the latest developments in organic chemical research at the present time. He was particularly well pleased with the logical development and the coherent way in which the speaker had marshalled his facts. Dr. Shutt, in proposing the vote of thanks, said that it was not often the members of the Society of Chemical Industry were given the opportunity to listen to so fine an exposition of a difficult piece of research and he voiced the appreciation of the audience to Dr. McRae for his most interesting discourse.

After the paper, a number of the members questioned Dr. McRae on various points raised, and an interesting discussion followed.

Coming to the business of the meeting, Mr. Hambly said that the first convention of Canadian Chemists had been held in Ottawa five years ago, and since that time in Toronto and Montreal, two meetings having been held in the latter city. He pointed out that the Royal Society meets in Ottawa and for this reason Ottawa is located advantageously for a meeting of the Canadian Chemists. Moreover, the meeting of the Advisory Committee in Chemistry of the Research Council will also meet in Ottawa during the same week as the Royal Society of Canada, and it had been intimated that the Canadian Institute of Chemistry would likely come here also. He suggested that formal invitations be sent to Mr. Theo. H. Wardleworth, representing the Canadian Council of the Society of Chemical Industry, and Mr. H. J. Roast, representing the Canadian Institute of Chemistry, inviting both organizations to meet in Ottawa in annual meeting this year. He said that he had been speaking to Professor Ruttan and also to Professor J. Watson Bain, both of whom were agreeable to this proposal. Some discussion followed regarding the nature of the programme which might be arranged and it was suggested that Dr. Shutt take up with the Secretary of Section Three of the Royal Society, the subject of a joint meeting with that body on Wednesday, the first day of the Royal Society meeting. Dr. Shutt agreed to discuss the question with the Secretary of the Royal Society and to report back.

It was then moved by A. E. McRae, seconded by R. T. Elworthy: That the Canadian Council of the Society of Chemical Industry and Council of the Institute of Chemistry be tendered invitations to hold their annual meetings in Ottawa this year during the week of the Royal Society meeting.

S. J. COOK, Secretary.

CHEMICAL SOCIETY NOTES.

The Industrial Chemical Club of the University of Toronto held its annual dinner at the Walker House on March 14. Mr. J. E. De Cew, of Process Engineers, Inc., New York, spoke to the undergraduates and senior men on the outlook in the chemical profession. Professors J. W. Bain, E. G. R. Ardagh and M. C. Boswell were present and spoke. Mr. H. A. Fair is President of the Club.

DOMINION CHEMIST ADVISES FARMERS TO ACQUIRE CHEMICAL KNOWLEDGE OF FARM PROCESSES.

Dr. Frank T. Shutt, Dominion Chemist, Experimental Farms, Ottawa, has issued a note to Canadian farmers, calling on them to devote more time to the reading of chemical literature, such as is distributed by the Department, bearing on the application of chemistry to agriculture. He advises the young men and women in particular to give fifteen minutes a day to the bulletins of the Department, reports of agricultural institutions and to the more educational articles and papers in the agricultural press.

ENQUIRY FOR MEMBER'S ADDRESS.

The Secretary of the Canadian Institute of Chemistry would like to know the present address of Mr. F. E. Gardner, associate member of the Institute. Mr. Gardner's address on the register of the Institute is given as 348 Sherbrooke St. W., Montreal. Anyone knowing his present address will kindly communicate to the Secretary, H. J. Roast, 393 Guy Street, Montreal, Que.

TECHNICAL AID TO RUSSIA.

The Engineering Section of the Society for Technical Aid to Soviet Russia, with offices at 110 West 40th St., New York, is making an appeal to engineers and chemists to send back numbers of standard technical and scientific papers to Russian Institutes and men of science. If you are not keeping your journals, the Society would be pleased to hear from you at the above address.

Dwight P. Robinson & Co., engineers, New York and Montreal, have a staff of 150 men engaged in the state of Ceara, Brazil, constructing five large dams for the Brazilian Government. These dams will hold in force immense reservoirs of water for irrigation purposes.

World Conditions and News in Chemical Fields,

(Special Correspondence to Canadian Chemistry and Metallurgy by Our London Representative)

ONE of the most important developments in the field of heavy chemicals in Great Britain during 1921 is in the production of ammonia from the air by the new Brunner-Mond plant at Billingham-on-Tees. This factory was begun in 1918 by the Ministry of Munitions, and was designed for the manufacture of 60,000 tons of ammonium nitrate per annum; it is now being re-designed for the manufacture of fertilizers. A subsidiary company, Synthetic Ammonia and Nitrates, Limited, was formed in 1920 with a capital of £5,000,000 to take the plant over from the Government and to develop the production of nitrogen products on a commercial scale. When finished the new plant will produce 25 tons of nitrogen per day, or about 6,000 to 7,000 tons per annum, at Billingham, where the works cover about 850 acres. The plant is designed for what is understood to be an improvement on the famous Haber method of producing synthetic nitro-compounds, which was originally worked out by the Badische Anilin und Soda-Fabrik in the works recently destroyed by explosion.

Messrs. Brunner, Mond & Co., Limited, have also in the course of erection at Winnington, near Northwich, Cheshire, a plant for the manufacture of alkali by a new method.

Repeal of the Safeguarding of Industries Act.

A Bill was introduced in the British House of Commons on the 14th of February for the Repeal of the Safeguarding of Industries Aot. Though supported by a number of members of the Government party, it was defeated by 170 to 92. This measure, it may be recalled, levies duties amounting to thirty-three and one-third per cent. on numerous varieties of chemical products imported into Great Britain from abroad.

British Advances in the Manufacture of Fine Chemicals.

Evidence is to hand of efforts being made by a number of British manufacturers to supply in adequate quantities fine chemicals of the required degree of purity for analytical and research purposes, for which the world was prior to the war mainly dependent upon Germany. The catalogue of one firm now includes over 2,500 such chemicals; new buildings are being erected, young chemists are being specially trained to devise and regulate the complicated and highly technical processes.

An outstanding difficulty facing all manufacturers of fine chemicals is the very limited demand for these products—this naturally is reflected in production costs. It is to be hoped that the manufacturers and users will co-operate more and more, as it is obvious that with an increased output production costs can be considerably reduced, to the benefit of both manufacturer and user alike; in this their interests are parallel. In many quarters users are feeling that their interests are prejudiced by a moderate form of protection.

Alsace-Lorraine Potash.

The mines in Alsace-Lorraine are now producing the equivalent of 230,000 metric tons of pure potash (K_2O) per annum, but exploitation is being extended, improved methods of extraction and purification are being introduced, and more shafts are being sunk with a view to increasing the output. By the end of 1922 the rate of extraction will be about 8,500 t. of crude salts a day, and in four or five years it is hoped that the annual production will be over 4,000,000 t. (600,000 t. K_2O), an amount equal to one-half of the world's annual production before the war. Attention is being directed towards discovering extensions of the potash-bearing area; bores sunk to 2,925 and 3,250 ft. in the Belfort district did not yield positive results, and a bore sunk at Buggingen in Baden, on the opposite bank of the Rhine, revealed a layer of potash salts 13 ft. thick, but not of commercial importance.

New German Aluminium Alloy.

At the last Automobile Exhibition in Berlin there was on show a new alloy consisting of 86-89 per cent. of aluminium with 14-11 per cent. of silicon, and having a specific gravity of 2.5 to 2.65, a tensile strength of 20 kilogrammes per square millimetre, hardness at room-temperature of 60 kilos per square millimetre, the hardness at 350 degrees Centigrade being 20-25 kilos per square millimetre (with a 500 kg. load and a 10 mm. ball). The alloy, which is called "Silumin," is not attacked by wet steam, and is less affected by 25 per cent. or concentrated nitric acid than is aluminium, which it otherwise resembles. Silumin is made either directly from its elements, with certain additions, or in the electric furnace.

Reconstruction of French Metallurgical Industry.

The reconstruction of works continued steadily during 1921 in the devastated areas. Several of the steel works are already prepared to resume operations, and those at Homecourt, Denain-Anzin, Midieville and Nord-Est will begin production this year. The slump in trade has, of course, proved a setback to the efforts being made to re-establish production, and progress in the present year must be slow until financial resources of the operating concerns are larger. It is, however, anticipated that all the works in the devastated regions will be restored by 1925 or 1926. Last year's output of pig iron and steel was between three and three and a half million tons, as compared with a pre-war production of 5,000,000 tons. It is hoped eventually to produce 11,000,000 tons in France (excluding Lorraine).

Motor Spirit Production in Sweden.

Sweden, like Canada, possesses a great wealth of raw material for the manufacture of power alcohol in the waste lye derived from the process of sulphite wood pulp production. There are at present in Sweden twenty-two sulphite spirit distilleries, capable of a total output of 20,000 tons of 100% alcohol per annum. It is further reckoned that if all the large sulphite pulp mills were to erect spirit distilling plants, the total output could be doubled. Moreover, by the methods of distillation at present employed, only part of the lye can be utilized, so that with a completely-organized system, the output could be increased to 60,000 tons of 100% spirit. As the annual consumption of petrol in Sweden amounts to between 40,000 and 50,000 tons, it is held to be possible in the near future for the country to become wholly independent of imported supplies. Sweden, however, is confronted by the difficulty usually connected with the production of alcohol in countries where sentiment in favor of the prohibition or restriction of intoxicating liquor consumption is concerned, as there is anxiety among advocates of that policy as to the abuse of technical alcohol should it come into general use for industrial purposes.

The British Malayan Market for Tar and Pitch.

Producers of tar and pitch have a fairly good market in British Malaya, where the former material is used in considerable quantities for ships, as a binder for road metalling, for painting laborers' quarters, and for treating rubber trees. Some Swedish tar is imported, but the bulk of the import is from Great Britain and consists of coal-tar, which is packed in barrels of 532 to 560 lb. The quality of the tar suitable to this market is thick and has a large covering power with great consistency. The price varies from 37s. to 45s. per barrel, c.i.f. Singapore or Penang. All coal-tar barrels should have a brass label showing net contents, and should bear a brand or trade mark.

Tin Exports of Malaya.

For many years, British Malaya contributed more than one-half of the world's tin supply, and to-day the Federated Malay States still hold first place as the largest individual producers, though the export has fallen from 50,837 tons in 1908 to 34,446 tons in 1921. The tin-ore exported from the hinterland is smelted in Penang and Singapore, and Straits tin takes the highest rank in the metal markets.

Tin exports from the Straits Settlements ports are shown in the following table:

	Tons.	Value.
1913	65,700	£13,171,582
1914	66,233	9,988,605
1915	68,782	10,686,813
1916	65,231	11,392,201
1917	64,031	11,782,071
1918	55,045	16,755,379
1919	59,342	15,017,368
1920	49,307	14,905,850

Electrolytic Zinc in Australia.

According to the first annual report of the Electrolytic Zinc Company of Australia, which has its works at Risdon, near Hobart, Tasmania, the year's workings resulting in a loss of £5,086, which is to be capitalized as "general development and investigational research costs."

According to the report, the following will be the annual plan of the company when the plant is in full operation:—From the residues which will be shipped to Port Pirie and smelted for the recovery of lead and silver the quantity of these items recoverable will approximate 6,000 tons lead and 1,100,000 ounces silver; will handle over 100,000 tons of Australian zinc concentrates; produce sulphur gas equal to 30,000 tons of sulphur; produce 40,000 tons of metallic zinc, 2,000 to 3,000 tons zinc oxide, and eventually up to 100,000 tons of leaded zinc oxide. An assured supply of zinc concentrates is secured to the company by the contract recently made with the British Board of Trade for the purchase by this company of 750,000 tons at a satisfactory figure. A tonnage sufficient to satisfy this contract has already been produced, and lies stacked at Broken Hill.

Australian Oil Shales.

The general method of retorting shale is well known, but the variation of this method as employed by the Oil Shale Company at Joadja is entirely new. The shale is fired inside a retort, the original fuel being wood or coal; about 1cwt. was sufficient to start the experimental retort. Once it was raised to a red heat it stayed in that condition, being fed with fresh shale at intervals. The vapor that is given off goes into a condenser, where it is converted into a thick, heavy oil, the lighter bodies rising to the top. This is drawn off by a pipe, placed at the proper height, a second smaller tank being thereby filled. The process is continued until a third tank is filled with an extremely light oil—a mixture of kerosene and petrol—with a slight percentage of solids. From the last tank the gasses that are incapable of condensation are caught by the blowers and forced back to the furnace to maintain the glow.

The Nauru Phosphates.

An interesting report on the commercial exploitation of Nauru and Ocean Islands by Mr. H. B. Pope, one of the Board of Commissioners, has been tabled in the Australian Federal Parliament.

The commission took over the business on July 1, 1920. Under the Nauru Island Agreement Act, 1919, the United Kingdom is entitled to 42 per cent. of the annual output, Australia to 42 per cent., and New Zealand to 16 per cent. The price paid by the three Governments to the Pacific Phosphate Company, which at the outbreak of war controlled the deposits on both islands, was £3,500,000 in the proportions which now apply to the output. Incorporated in the scheme are the Ocean Island deposits.

Outlining the extent of the deposits, Mr. Pope, inter alia, says:

"Quite a number of misleading statements as to the quantities of phosphate on Nauru and Ocean Islands have been made, but it can safely be said that, at the present moment, there are on Nauru and Ocean Islands not less than 100,000,000 tons of some of the highest grade phosphate known to exist. Soon after the Pacific Phosphate Company commenced operations on Nauru it sent an eminent Australian mining engineer to make a survey of both islands, and to ascertain, as nearly as possible, the extent of the deposits. This expert subsequently reported that there were at least 42,000,000 tons on Nauru, and about one-third of that quantity, or 14,000,000 tons, on Ocean Island. Several years later another mining expert was instructed to make independent surveys and calculations, with the result that he fully confirmed the figures given by his predecessor. These quantities worked out at a certain number of tons to the acre for the total acreage available. Experience gained in working Nauru for the last 15 years and Ocean Island for the past 21 years (Nauru was commenced in 1906 and Ocean Island in 1900) proves, however, that these figures can be doubled, and the resultant total of 112,000,000 tons would still be within the mark. About 3,750,000 tons have already been removed, but, as already stated, there are, at the present moment, not less than 100,000,000 tons of available phosphate. How much more there might be it is impossible to say, for the comparatively few fields classed as 'worked out' were abandoned, not because the phosphate was exhausted, but because it had become difficult to work, deposited as it is between coral pinnacles. After a depth of from 20 to 30 feet between the pinnacles has been reached, it does not pay, under present conditions, to work that field any further. The deposits on Ocean Island have been estimated by Mr. Ellis, the Commissioner for New Zealand, at probably 30,000,000 tons of available phosphate, but, he adds, this quantity may be much exceeded. It is hoped that the total output from Nauru and Ocean Islands will soon reach 500,000 tons per annum, but even if an annual output of 500,000 tons from each island is reached and maintained, there are at least 100,000,000 tons to be removed before the deposits will become exhausted.

Mineral Production in Canada, 1921.

The Canadian mining industry passed through a very difficult period of readjustment during 1921, but came through the year remarkably well, everything considered. The Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics, under the direction of Mr. S. J. Cook, has prepared a preliminary report of the production for 1921, which shows that the break in prices of most metals during the last quarter of 1920 and which continued throughout 1921 was chiefly responsible for the difficulties experienced. The aggregate value of the economic minerals produced reached a total of $172,327,580 (Canadian funds) in 1921, as compared with $237,422,857 (Canadian funds) in 1920. During the past two years the variation in the rate of exchange prevailing between Canada and the United States has been a considerable factor in determining the value to the producer marketing his product in the United States. Toward the close of 1921 mineral markets became somewhat more active, prices showed a slight tendency to rise and with the gradual absorption of stocks left over from the abnormal activities of the war period a general improvement was observed.

Production By Provinces.

Ontario led in value of production in 1921, followed in order by British Columbia, Nova Scotia, Alberta, Quebec, Manitoba, Yukon Territory, New Brunswick and Saskatchewan.

The following table shows the production by Provinces:

Mineral Production by Provinces, 1920 and 1921.

	1920		1921	
	Value of Production	Per cent. of total	Value of Production	Per cent. of total
Nova Scotia	$34,130,017	14.98	$32,569,352	18.9
New Brunswick	2,491,787	1.09	1,777,358	1.0
Quebec	28,886,214	12.68	14,679,087	8.5
Ontario	81,715.808	35.86	54,505,770	31.6
Manitoba	4,223,461	1.85	2,075,807	1.2
Saskatchewan	1,837,468	0.81	1,086,610	0.6
Alberta	33,586,456	14.74	28,927,968	16.8
British Columbia	39,411,728	17.30	34,776 894	20.3
Yukon	1,576,726	0.69	1,928,734	1.1
Total	$227,859,665	100.00	$172,327,580	100.0

Production of Principal Minerals.

Arranged in order of value, the ten principal products of the Canadian mineral industry in 1921 were: Coal, gold, silver, copper, nickel, natural gas, asbestos, lead, zinc, and gypsum, the aggregate value of these being $131,447,114.

Coal—While the output of coal declined 12 per cent. from the quantity mined in 1920, it was not as low as in 1919. Alberta was the principal producer, but was only slightly in advance of Nova Scotia. Production in British Columbia was about the same as in 1920, while New Brunswick was the only province to exceed its 1920 output, although Saskatchewan came within one per cent. of doing so. Considerable work was done in Alberta in an attempt to establish conditions under which Alberta coal might be moved East on a paying basis. The total output of coal in 1921 amounted to 15 million short tons, valued at $74,273,000. Of this amount 11,627,800 tons was bituminous, 96,964 tons was anthracite, and 3,217,654 tons was lignite.

Gold—Ontario was again the chief gold producer, and although production was curtailed owing to shortage of power, the output in Ontario reached a value of $14,624,085. The most attractive feature of gold production from the producers' standpoint was the fact that all gold sold to the Royal Mint at Ottawa was paid for in New York funds. The recent rapid approach of the Canadian dollar towards par with the American bids fair to wipe out this advantage, but, nevertheless, production may be expected to increase since a considerable demand for gold exists and if European countries are ever to get their currency back to anything like the gold basis large quantities of gold will be required. British Columbia increased its gold output from 124,808 ozs. in 1920, to 149,397 ozs. in 1921.

Silver—In spite of the fact that the average price for silver in 1921 was less than two-thirds of that prevailing in 1920, the output was very creditable and amounted to 13,134,926 ozs., valued at $9,185,007, compared with 13,330,357 ozs. value at $15,100,685 in 1920, a decrease of only 1.46 per cent. in quantity, but 39.17 per cent. decrease in value. Production in Ontario amounted to 8,412,059 ozs. Production from the Yukon increased from 19,190 ozs. in 1920 to 393,617 ozs. in 1921, due to some important shipments of silver-lead ores from the Keno Hill area

Copper—The total production of copper from all sources in Canada during the twelve months of 1921 was 53,461,795 pounds which at the average monthly price on the New York market for electrolytic copper of 12·502 cents would be worth in Canadian funds, $7,459,780, exchange being computed at $1·1161, the average monthly premium for the year. In 1920, when the average price of copper in New York was 17·456 cents a pound, Canadian production amounted to 81,600,691 pounds, and the value, computed on the same basis as before, but with exchange at $1·1227 was $15,991.982. From these data it will be seen that the copper industry has suffered a severe decline. This is more strikingly shown when the 1921 figures are compared with those of the year 1918, when a total of 118,769,434 pounds with a value of $29,250,536 was produced. In common with other copper producing countries the industry in Canada is passing through a quiescent period, and at the time of writing no immediate improvement can be observed.

Of the production during 1921 a total of 50,353,645 pounds was contained in blister copper and in matte produced in British Columbia and Ontario. The balance of 3,108.150 pounds was estimated as recovered from ores shipped to the United States for treatment, and as contained in copper sulphate. The total production of refined copper amounted to 4,286,740 pounds produced at the electrolytic refineries of the Consolidated Mining and Smelting Company at Trail, British Columbia, and by the British America Nickel Corporation, Deschenes, Quebec. The production by these companies during the period showed a decrease when compared with that of former years, but the output at Anyox by the Granby Mining, Smelting and Power Company remained about the same as formerly, namely, about 2,500,000 pounds of converter copper monthly.

The production from Quebec also showed a decline from that of former years. It amounted to 266,188 pounds valued at $37,141 (Canadian). The output was mainly from the copper-bearing ores which were first treated for their sulphur contents, and the resulting cinder then exported to the United States for the recovery of the copper. Seventy-five per cent. of the copper contents of the exported product was estimated as recoverable.

Ontario's production amounted to 12,763,477 pounds valued at $1,780,948, as against 32,059,993 pounds valued at $6,283,069 in 1920.

The production was principally derived from the copper-nickel ores of the Sudbury District, and was mainly in the form of matte. During 1921 the copper contents of the matte produced by the Mond, International and British America companies amounted to 12,645,391 pounds. During the last half of the year the plants of the British America and the International Nickel Companies were practically closed down owing to the dormant market prevailing and production fell off accordingly. The silver-cobalt ores or residues exported contained a further small amount from which it was estimated 27,819 pounds of copper would be recovered. The South Ontario silver smelters also produced and sold 361,068 pounds of copper sulphate, the copper contents of which (or 25 per cent.) was included as copper produced in the total for Ontario.

Manitoba did not produce any copper during the year. In 1920 the Mandy Mine shipped some 7,535 tons of ore to Trail, which had been mined during 1919. With the difficulties of transportation, increased freight rates, and a greatly curtailed market, the economic production of copper in the province was impossible.

The production from British Coluumbia was very creditable. The performances of both the Granby and Consolidated companies at Anyox and Trail, respectively, were excellent considering the difficulties confronting the industry. The total production amounted to 40,432,130 pounds, valued at $5,641,690, as against 45,319,771 pounds, valued at $8,881,701 in 1920. The output included 37,780,098 pounds as blister or converter copper, and copper in copper sulphate, and 2,652,032 pounds estimated as recovered from ores exported. The year was marked by the destruction of the large concentrating plant at Britannia.

Nickel—The marketing of nickel was so difficult throughout the year that operations at the mines were curtailed to approximately half the normal rate. Early in the year the British America Nickel Corporation discontinued operations and later the International Nickel Company followed suit. The Mond Nickel Company, while operating throughout the year did so far below capacity. The limitation of the construction of war vessels means that the future demand for nickel must come largely from industrial and domestic uses. Most of the nickel produced in Canada is used in the manufacture of nickel steels, and the revival of the steel industry which is expected should materially assist in using up stocks now on hand. The total Canadian nickel output in 1921 was 19,293,186 lbs., as compared with 61,335,706 lbs. in 1920. The value of the 1921 production at 35 cents per lb., the average price, was $6,752,615.

Asbestos—The production of asbestos declined in 1921 to less than half of the 1920 output. Practically the whole of the Canadian production of asbestos in Canada is exported to the United States and thence to Europe. Owing to the adverse exchange situation between the countries of Europe and the United States trading in asbestos was almost at a standstill throughout the year and as a consequence the demand for this product was very slight. Operations were continued at some of the mines throughout the year, but generally conditions were very dull. One of the principal difficulties confronting Canadian producers is the profitable disposal of low-grade product. The spinning fibre, for which there is a constant demand, represents only a very small proportion of the entire output, and ways and means have yet to be devised to find profitable markets for the large quantities of the low-grade material produced by the normal processes of working. The total production of asbestos in 1921 was 90,407 tons, valued at $4,807,052.

Lead and Zinc—Lead and zinc ranked eighth and ninth respectively among the mineral products of Canada during the year, and notwithstanding the general decline in prices during the past two years the quantity of lead recovered increased more than 86 per cent. above the quantity produced in 1920 and was valued at almost 20 per cent. more than the output of the preceding year. Practically the whole of the production was from the smelters at Trail, which continued active throughout the year. Some lead was produced from Ontario and Quebec ores also, production from these provinces being about the same as in previous years. Zinc increased one-third in quantity, but fell off 17 per cent. in value as compared with the production in the preceding year. The output of both metals was, however, most outstanding when the mineral industry as a whole is taken into consideration. Total production of lead in 1921 was 67,146,011 lbs., valued at $3,855,524; the total production of zinc was 53,095,609 lbs., valued at $2,758,552.

Gypsum was the tenth product of value from the mines of Canada, the bulk of the production being from the Province of Nova Scotia, although Ontario, Manitoba and New Brunswick also contributed substantially.—Abstracted from Preliminary Report of Mineral Production of Canada, 1921, Dominion Bureau of Statistics, Ottawa.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy.)

Severe weather during February so deminished the Granby company's water supply, from which it derives power to operate its mine and smelter, that operations had to be greatly curtailed. This has happened before during severe winters, and with a view to obviating it in the future, the company has made arrangements to construct a 25,000 acre-foot reservoir during the coming summer. At the time of writing the company has only one of its four furnaces in operation.

Premier Delivery Is Rapid.

The new tramway at the Premier mine has been delivering ore faster than it has been possible to get steamers to take it away, and consequently it has had to be stopped for several days to allow the ore-bunkers to be cleared. It is stated that during the first six weeks of the year 6,000 tons of ore and concentrate were shipped from Stewart. The company is now shipping medium-grade ore, running about $50 per ton in gold and silver, to the Granby company's smelter at Anyox.

Revival of Placer Mining.

Present indications point to a great revival of placer gold mining in the province during the coming summer. Though little prospecting can be done before the middle of April, some 100 prospectors have assembled at Cedar Creek, in the Cariboo district, where the discovery of rich placer ground was made last fall.

I. X. L. Makes Third Shipment.

The lessees of the I. X. L. mine, at Rossland, have shipped another car of bonanza ore, said to run in the neighborhood of $7,000 per ton, to the Bunker Hill & Sullivan smelter, at Kellogg. This makes the third shipment of this ore, which has paid both the operators and owner of the mine a handsome profit; the latter getting 20 per cent. royalty on all ore shipped. Besides continuing to operate the I. X. L., the lessees will re-open the O. K. mine, also at Rossland, and from which some pockets of very rich ore have been mined in the past.

B. C. Metallurgists Meet.

The British Columbia branch of the Canadian Institute of Mining and Metallurgy held a most successful meeting in Vancouver during the middle of February, at which most useful papers on the geology of the Britannia and Dolly Varden mines, the Chu Chua coal basin, and the Mackenzie River oil-fields were read. The Northwest Mining Convention was held at Spokane, unfortunately, at the same time, and a number of members of the Institute whose interests are in the Kootenays attended the convention in Spokane. Both conventions were marked by a pervading spirit of optimism; the general opinion being that the worst was over and that the coming year was likely to be a prosperous one for the mining industry of the Northwest.

BRITISH COLUMBIA INDUSTRIAL NEWS.

Owing to the Canadian Government Merchant Marine giving a lower freight rate, the Sidney Roofing & Paper Company have obtained an order from Los Angeles for 1,400 tons of roofing felt. This order will keep the plant, which is situated on Victoria Harbor, busy for the next two months.

The Curtis Publishing Company, of Philadelphia, is said to be taking the whole of the output of the Whalen Paper & Pulp Company's mills, all three of which now are working at capacity.

The Nelson Match Block Company has resumed operations, after a shut-down for alterations and repairs. The factory turns out one car of match blocks daily, and gives employment to 35 persons.

YUKON TERRITORY DEVELOPMENTS.

Mining men arriving at Dawson from the Mayo district during the first two weeks of March, report that a number of new rich strikes have been made at Keno Hill. Veins of high-grade ore have been opened on the Croesus, Crystal Gulch, Gambler Gulch, Slate Creek and Stone claims. On one of its claims the Slate Creek Mining Company is mining a five-foot lode of high-grade argentiferous galena at a depth of 65 feet.

The Yukon Gold Company has some 3,000 tons of high-grade silver lead ore delivered at Mayo Landing, ready for shipping as soon as navibation opens. In one of its shafts on the Rico claim the Yukon Gold Company is mining at a depth of 300 feet, and the ore is reported to be as rich and the vein as large as at the surface.

The Treadwell Interests are sinking two shafts on the Sadie claim, and have reached a depth of 100 feet in both shafts. These shafts are to be continued to a depth of 300 feet and are to be connected by three levels. The vein averages three feet in width in both shafts, and assays run from 200 to 500 ounces of silver per ton and 40 to 65 per cent. of lead.

During the past winter the McQuesten Slope vein has been opened by a series of open-cuts over a distance of nearly a mile in length. The vein ranges in width from five to fifteen feet between walls, and the general opinion is that it will be one of the big silver-lead camps of the world, and the fact that such well-known men as the Guggenheims and F. W. Bradley, president of the Bunker Hill & Sullivan Mining & Concentrating Company, being interested in its development, is a sufficient guarantee that it will be exploited to the fullest extent.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported specially for "Canadian Chemistry and Metallurgy" by A. E. MacRae, Ottawa.

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Process of Preparing Purified Gas Mixtures.
J. C. Clancy, 215383, January 24, 1922. A mixture of H and N is prepared by decomposing a hydrocarbon in presence of air and steam to prepare a mixture of H, N, oxides of C and water vapor, oxidizing CO to CO_2 and passing the gases in contact with NH_3 to eliminate CO_2 and purify the mixture.

Process of Preparing Hydrogen.
J. C. Clancy, 215384, January 24, 1922. Pure H is prepared by reacting with steam upon elemental S at 800° to 1200° and removing the SO_2 thus formed from the gaseous product.

Dry Cells
Walter B. Schulte, 215193, January 17, 1922. A battery having a Zn electrode in the form of a container has a contact terminal fixed directly against the container wall at the confining plane of the cup.

Recovery of Zinc by Electropsis.
215201, January 17, 1922. In the electrolytic recovery of Zn the Cl is removed from the Zn-bearing solutions by precipitation with Ag_2SO_4. The $AgCl$ is reconverted into a soluble Ag salt which is available for repeated use.

Method of Producing Fine Powders.
W. K. Lewis, 215214, January 17, 1922.

Process of Synthesizing Ammonia.
Jno. C. Clancy, 215381, January 24, 1922. A catalyst for NH_3 synthesis, containing an alkalinous metal, Fe cyanid on a pumice support, is stabilized by gradual heat treatment up to 450° in the presence of H and N to convert it into films of active material, while eliminating from the films a part at least of their cyanogen content. The synthesis of NH_3 is effected at about 450° and a pressure of 100 atms.

Catalysts and Method of Preparing the Same.
J. C. Clancy, 215382, January 24, 1922. A highly expanded catalytically active material is prepared by heating Cu or Ag cyanamide, either alone or mixed with each other or with other materials, such as metal derivatives of ferro and ferri-cyanides, to 250-350° in the presence of air until sudden expansion or puffing occurs. The Cu or Ag cyanamide may be used alone, but small proportions of the complex cyanogen metal derivatives enhance their catalytic activity.

Solder Paste.
A. Waletzky, 215346, January 24, 1922. A soldering paste contains NH_4Cl, 10 lbs.; $ZnCl_2$, 8 lbs.; powdered borax, 8 lbs.; crude glycerine, 19 lbs., and petroleum jelly, 55 lbs. To each pound of this mixture from 6 to 12 lbs. of Sn powder is added.

Process of Generating Hydrogen from Hydrocarbons.
J. C. Clancy, 215385, January 24, 1922. Gaseous hydrocarbon mixed with air and steam is brought into contact with an Fe-Cr alloy at 1200-1300°. The CO formed is converted into CO_2 and the latter is removed from the gas mixture.

Manufacture of Perborates.
J. K. Laughard, 215504, January 31, 1922. A solution of a borate is subjected to electrolysis, a superoxide is added to the electrolyzed solution and the perborate separated therefrom.

Manufacture of Sulphuric Anhydrid.
M. F. Chase, F. F. Pierce and I. Skogmark, 215552, February 7, 1922. A controlled mixture of SO_2, O and diluent gas is repeatedly circulated through a catalytic conversion apparatus and through an absorber for the product.

Process of Oxidizing Mercury.
H. W. Matheson, 215628, February 7, 1922. The Hg to be oxidized is used as the anode of an electrolytic cell having a cathode formed of a metal of the Fe group and a continuously agitated electrolyte. The violence of agitation is periodically increased to clear the Hg surface from oxide.

Process of Making Depolarizers for Electric Batteries.
H. F. French and R. C. Benner, 215676, February 7, 1922.

Process of Baking Carbon Electrodes.
C. W. Soderberg, 215697, February 7, 1922.

Recovery of Zinc by Electro Deposition.
H. Gepp, Wm. D. Avery, R. H. Stevens, W. C. Snow and W. M. Whitecotton, 215698, February 7, 1922. Zn is extracted from ores electrolytically in intermittent cycles consisting of depositing Zn in the usual way with additions of glue to maintain effective working and purifying with limerock and Zn dust, then removing impurities by precipitation with Zn dust in the presence of As and Cu and repeating the cycle.

Concentration of Minerals.
C. L. Perkins, 215709, February 7, 1922. A plurality of animo compounds certain of which have marked selective action and certain of which have good frothing qualities, is used as a flotation agent in ore concentration, i.e., 60 parts of alpha naphthylamin in 40 parts of xylidin.

THE CANADIAN ALUMINUM INDUSTRY.

The aluminum industry has progressed notably in Canada during the past ten years. There are now four separate companies operating plants in Canada. Two plants for the fabricating of aluminum into various industrial and domestic articles are situated in Toronto; a third plant is located at Oakville, Ont., and another at Hamilton, Ont. Aluminum ore is smelted at the plant of the Northern Aluminum Company at Shawinigan Falls, Que.

Aluminum ore (bauxite) is not found in Canada, but is imported mostly from the United States. During 1920, imports of aluminum ore were 1,166,990 cwts., valued at $2,052,478. Imports of aluminum ingots, block bars, rods, plates, etc., amounted in 1920 to 1,850,678 lbs. valued at $623,232. In spite of the fact that Canada has an industry already established for the making of aluminum utensils, Canadians imported such articles in 1920 to the value of $772,691. Imports of aluminum leaf or foil in 1920 amounted to $194,619, and of aluminum sulphate, $390,395. Exports from Canada of aluminum ingots, bars, rods, plates, etc., in 1920 amounted to $6,094,628, and of aluminum ware, $175,057. These exports were chiefly to the United States and Great Britain..

According to data of the Chemical and Metallurgical Section of the Dominion Bureau of Statistics the value of the aluminum domestic or hollow ware manufactured in Canada in 1920 was $1,392,894, while the value of the total manufactured products of aluminum was $1,647,797 in the working of which $610,872 worth of materials were used, so that $1,036,825 represents the value added to the materials used by the process of manufacture.

The total amount of capital invested in the industry in 1920 was $3,244,566, while 291 people were employed.

It is interesting to note that the aluminum industry in America is entering its 32nd year, as it was in 1890 that the first successful process was worked out for the economical extraction of the metal from its ores.

SUCCESSFUL PRODUCTION AT NEW MATCH PLANT.

Operations at the match plant of the Canadian Match Company, Limited, Pembroke, Ont., are proving successful, and the products of this concern are now on the market. This enterprise was started about a year ago but delays occurred which prevented any real production until December last. The general sales offices of the Company are in Montreal, and one-third of the stock is owned by MacGuire, Paterson & Palmer Company of Canada, Ltd., another third by Bryant & May, Ltd., of London, Eng., and the remaining third by the Diamond Match Company of the United States.

ALBERTA OIL DEVELOPMENTS.

Arrangements have been made between the Dominion Government and Chester P. Thompson, acting for the Thompson Oil Syndicate and the Sanctuary Oil Company, whereby the companies will explore and in the event of discovery develop the oil and natural gas resources of the Pakow-Ski Bird Reserve, of 1,920 acres, which is situated in southern Alberta, just north of the international boundary.

SECOND UNIT AT CHIPPAWA OPERATING.

During the week of March 13th, the second unit of the Queenston-Chippawa power development of the Ontario Hydro-Electric Commission, having a capacity of 55 to 60 thousand horse-power, was placed in operation. The third unit is being installed and is expected to be in operation in three months.

NEW BRITISH COLOR PROCESSES.

A fair number of applications have been lately made by British color firms for patents to cover new processes, new intermediates, and even new coloring matters. It is usually somewhat too readily assumed that the efforts of the dye manufacturers are occupied solely with the effort to reproduce German products. This effort must naturally remain for some time in the forefront of the British programme, but it should ultimately, though gradually, give place to work along original lines, and it is interesting to note that this process is already beginning. The production of an entirely new and very interesting vat dyestuff by Scottish Dyes, Limited, is a further sign of the same new growth; and there are others in embryo. These new shoots surely point to some vigorous life in the root of the British dye industry.

INDUSTRIAL ITEMS.

New Brunswick Foundry Increases Output.—The Enterprise Foundry Co., Ltd., Sackville, N.B., have completed a new steel shop 150 x 50 feet for working bodies for steel and gas ranges and a new wing for japanning. A number of new sheet metal working machines have been installed.

Experimental Match Plant at Nelson, B.C.—The experimental match plant established at Nelson, B.C., by J. D. Mantion, is working successfully and prospects appear bright for its ultimate future. The process as developed by Mr. Mantion is a new one, its chief advantage being the fact that green timber can be used for the splints.

New Oil Company.—Red Star Refineries, Ltd., is the name of a recently organized company who plan to erect an oil refinery plant at Montreal. The first unit of the plant will have a capacity of 1,000 barrels a day and the ultimate capacity will be 10,000 barrels daily. Hon. Senator N. A. Belcourt, K.C., is the president.

Kaustine Company Moves to Dundas, Ont.—The Kaustine Company, formerly of Toronto, have moved to Dundas, Ont., where they have secured control of the Dominion Welded Products Co. Steel tanks for water, gasoline, oil storage, and welded smoke stacks are the products of the plant.

New Polish Plant For Regina.—Household Products, Ltd., have established a plant at Regina, Sask., for the manufacture of furniture, metal, and shoe polishes; hand soaps, cleansing materials, water softeners, etc. Their operations are being scientifically directed by the Milton Hersey Co., Ltd., industrial chemists, Montreal.

Fuel Oil Station at Quebec.—It is reported that a 225,000-gallon fuel oil tank will be erected at Quebec Harbor, with the expectations of making Quebec the main fuel station on the St. Lawrence for all oil burning vessels.

Tank Works Locate at Galt, Ont.—The International Tank and Silo Co., Ltd., will erect a plant at Galt, Ont., one storey, 200 x 120 feet.

New Dye House at Welland, Ont.—Empire Cotton Mills, Ltd., Welland, Ont., plan to erect a dye house adjoining their plant at a cost of $200,000. Construction will commence within six months of the passing of the by-law granting a fixed assessment at $30,000 per year.

GETTING SODIUM SULPHATE PLANT READY.

The Bishopric Chemical Co., of Cincinnati, who are developing the deposit of sodium sulphate at Stink Lake, Sask., have erected a manager's residence, bunk house and cook house on their property. A railway spur has also been installed and machinery ordered.

RUBBER ASSOCIATION OF CANADA HOLD ANNUAL MEETING.

The second annual meeting of the Rubber Association of Canada was held at Montreal, February 14th. The President, Mr. C. H. Carlisle, of the Goodyear Tire and Rubber Company of Canada, presided. The report of the Association's manager and secretary, Mr. A. B. Hannay, showed that the Canadian rubber companies had come through the past difficult business year with considerable success. Prices of rubber goods were now 41 per cent. below pre-war years. The following officers were elected: President, W. A. Eden, Vice-Pres. Canadian Consolidated Rubber Company, Montreal; Vice-Pres., C. N. Candee, Gutta Percha Rubber Co., Toronto; Treasurer, John Westren, Dunlop Tire and Rubber Goods Co., Toronto; Assistant Treasurer, C. H. Carlisle; Manager and Secretary, A. B. Hannay.

BUSINESS NEWS.

It is reported that the British America Nickel Corporation has recently come to an arrangement with the British Metal Corporation, whereby that organization will be their exclusive British and European agent.

The Dominion Iron and Steel Co. reports that orders for Wabana iron ore have been closed with several steel companies in Europe. It is understood that a market for some three or four hundred thousand tons has been secured. Before the war, this Company did a large export trade in iron ore, as it can be loaded practically from the mine to ocean vessels and is of excellent quality.

CATALOGUES RECEIVED.

Laboratory Apparatus and Reagents.—This is the title of the latest catalogue issued by Arthur H. Thomas Co., West Washington Square, Philadelphia. It consists of 619 pages of descriptive matter, relating to the various chemical, metallurgical and biological apparatus supplied by this company, and, in addition, a code index and condensed price-list of 71 pages, followed by 104 pages featuring reagents, and concluding with a general index to the whole volume. We believe we are but voicing the opinion of all those in the laboratory supply business, who have seen this catalogue, that it is one of the very best that has so far been produced, covering these fields. One of the chief features of the catalogue is the readiness with which any particular item can be found. The alphabetical system is followed throughout, and this, together with the index, makes it easy to instantly locate the apparatus required. The illustrations, describing the apparatus, are as complete as could be desired and constitute one of the finest series of pictures of scientific equipment that we have yet seen. Another feature that is of considerable advantage is the large amount of detailed information given about every piece of equipment. Each piece of apparatus is priced, and in this connection, the Company announce that some pronounced reductions in many important items, particularly lamp-blown and volumetric glassware, have been put into effect, since the forms were closed for the printing of the catalogue. In the code index and condensed price list, a code word is given for each size of every item in the catalogue. The use of this index will undoubtedly be found convenient and time-saving. This code index will be republished from time to time, to take care of changes in prices of articles described and listed in the catalogue. The code words are permitted both for inland and transoceanic despatches.

Chemical, Oil and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points

The general chemical market at the beginning of April shows somewhat increased signs of the activity that commenced about the middle of February and continued more or less throughout that month and March. There have been, of course, "off days." The course of the chemical market towards more buying and stabilized prices has not been an easy one. Price cutting has featured many items and the volume of business has been disappointing in some of the leading chemicals, such as soda ash, Glauber's salt, and the heavy acids. But, taking the market as a whole, there is undoubtedly a fair advance in trading, and several lines show increased quotations. Business from the rubber trade is fair, while the paint and varnish industry is more active in the market than it has been for some time.

Caustic Soda and Bleaching Powder.—Caustic soda is firmer, and sales have noticeably increased. The solid grade has advanced ¼c per pound and the ground is holding firm at 6¼c to 6½c. Bleaching powder is a little more active and quotations, while not showing any tendency to advance as yet, are remaining steady.

Magnesium Sulphate and Glauber's Salt.—The demand from the tanneries for magnesium sulphate is keeping up fairly well, several good-sized shipments being reported during the closing days of March, though not as large a quantity moved in March as in February. Sales of Glauber's salt to the tanning and textile trades fell off during March. There has been considerable price-cutting on Glauber's, but it is well known that those dealers who have been slashing quotations in order to get business at any cost, cannot possibly take care of the demand once the textile plants and tanneries are more actively in the market.

Advances.—Yellow prussiate of soda .02c, lithopone 1c, carbon bisulphide .02, potassium bicarbonate .02, caustic soda .01¼c. (All advanced the amount stated.)

Pharmaceuticals.—With the exception of the iodides, the bromides and salicylic acid, all of which have advanced, there has been little change in the pharmaceutical chemicals. Camphor and benzoic acid have declined. Taking it on the whole, conditions are showing improvement and prices more stability in the pharmaceutical trade.

Linseed Oil.—Quotations on linseed oil are weaker, a drop of 20 cents on the gallon having occurred since March 1st. The raw is quoted at 95 cents per gallon in single barrels and 94 on 5-barrel lots. A stronger market is not expected for some weeks yet, as Argentine seed is down considerably on quotations.

Turpentine and Resins.—Turpentine declined 10 cents on the gallon since March 1st, while resins are holding to the same level—$7.50 for grade G and $10 for the W.W. On April 1st, turpentine was quoted at $1.15 per gallon at Toronto in 5-barrel lots and up. The season's crop has been running some four weeks now in the South, and, although there were some reports of damage by frosts, the supply this year is expected to be plentiful.

Industrial Gases.—Quotations on industrial gases remain steady and business is fairly good. Though demand from the construction trades has been poor, new business from smaller users is good and has kept prices firm. The demand for hydrogen for light sheet welding and cutting is very good, while the producers of oxygen and acetylene are finding a growing market for these gases among the blacksmithing, repair and machine shop trades. The sales of the Prest-o-Lite Company to laboratories are said to be very encouraging.

METALS.

With the exception of copper there is renewed activity in the metals. Copper remains dull, though recent New York reports predict an early rise in quotations. Lead and zinc have both improved their position, and business in these metals is considerably better. The improved lead market is reflected in the action of the Consolidated Mining and Smelting Co. announcing that their stock of lead has been completely sold, and that they have decided to increase the capacity of their lead refinery at Trail, B.C., from its present capacity of 90 tons to 150 tons per day. Work on these improvements has already started. The steel market has improved, and demand for both bars and plates is increasing steadily. The output of ingot steel in Canada was 9,000 tons higher in February than in January, 42,388 long tons being made, comprising 40,939 tons of ingots and 1,449 tons of direct steel castings. Tin and brass remain unchanged in price, but buying shows some improvement.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.75— 5.25
Ammonium Bromide	Lb.	.. — .38
Aluminium Sulphate, bags	100 Lbs.	.. — 2.50
Aluminium Sulphate, iron free	Cwt.	.. — 4.50
Ammonia, Aqua, 26, Carboys	Lb.	.. — .15
Ammonia, Aqua, 26, Drums	Lb.	.. —.09¾
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb.	.. — .14
Barium Sulphate (Barytes)	Pre Ton	30.00—35.00
Barium Chloride	Lb.	.04½— .06
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb.	.. — .22
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	.03¼— .04
Borax, crystals	Lb.	.06¾— .07
Boric Acid, powdered	Lb.	.. —.11¼
Bromine (technical)	Lb.	.. — .38
Calcium Carbide, car lots, f.o.b. works	Tor	.. —100.00
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —105.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	.. —110.00
Calcium Chloride, fused	Per Ton	36.00—38.00
Calcium Chloride, flake	Ton	40.00—42.00
Caustic Soda, ground, drum	Cwt.	6.25— 6.50
Caustic Soda, solid, drum	Cwt.	5.00— 5.75
Camphor Monobromate	Lb.	.. — 3.00
Carbon Bisulphide, in drums	Lb.	.. — .12
Carbon Tetrachloride, drums	Lb.	.19— .20
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, imported	Per Ton	20.00—25.00
Cobalt Oxide, black	Lb.	.. — 2.20
Cobalt Oxide, grey	Lb.	.. — 2.45
Copperas (Iron Sulphate) crystals	Lb.	.02¼—.02½
Copperas (Iron Sulphate) sugar	Lb.	.02¼—.02½
Copper Sulphate (Blue Vitriol)	Lb.	.07½—.08½
Corrosive Sublimate (Mercuric Chloride)	Lb.	.. — 1.00
Fluorspar, ground	Tons	.. — 30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.11— .12
Ferric Chloride, solution	Lb.	.. — .10
Hydrofluoric Acid, 60%	Lb.	.. — .30
Hydrofluoric Acid, 30%	Lb.	.. — .14
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	.70— .75
Iodine, crude	Lb.	.. — 4.50
Iodine, resublimed	Lb.	.. — 5.25
Iron Oxide (red)	Lb.	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.15— .17
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.. — .10
Lithium Carbonate	Lb.	.06— .07
Lithopone	Lb.	.. — 1.70
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl	Lb.	.09— .11
Magnesium Sulphate	Lb.	.03— .04
Mag. Sulphate, B.P., Medicinal	Single Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Muriatic Acid, 18	100 Lb.	2.75— 3.00
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt	Lb.	.. —.16½
Nickel Salt, double, barrel lots	Lb	.. — .15
Nickel Salt, double, per cwt	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lb.	.09—.09¼
Phosphoric Acid, 85%	Lb.	.. — .28
Phosphoric Acid, 50%	Lb.	.. — .22
Phosphorus, yellow	Lb.	.. — .34
Potash Prussiate, yellow	Lb.	.28— .30
Potassium Bicarbonate	Lb.	.. — .20
Potassium Bromide, crystals	Lb.	.22— .30
Potassium Bromide, granular	Lb.	.22— .30
Potassium Bichromate	Lb.	.. — .25
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .08
Potassium Chlorate	Lb.	.. — .10
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .80
Potassium Hydroxide (caustic potash) small drums	Lb.	.15— .20
Potassium Hydroxide (caustic potash) large drums	Lb.	.08— .10
Potassium Iodide	Lb.	.. — 4.10
Potassium Nitrate, kegs	Lb.	.14— .16
Potassium Permanganate, bulk	Lb.	.65— .70
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. — 9.00
Soda Ash, bags	Cwt.	2.60— 2.70
Sodium Acetate, ton lots or over	Lb.	.. —.06½
Sodium Acetate, lesser amounts	Lb.	.. —.07½
Sodium Benzoate	Lb.	.45— .50
Sodium Bicarbonate, 100% pure	Lb.	2.75— 3.25
Sodium Bichromate, bbls	Lb.	.10— .13
Sodium Bisulphite, powder	Lb.	.. —.07½
Sodium Bisulphite, 35	Lb.	.05½— .06
Sodium Bromide (foreign)	Lb.	.30— .35
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. — .31
Sodium Hyposulphite, kegs	100 Lb.	5.50— 6.00
Sodium Iodide	Lb.	.. — 4.60
Sodium Nitrate, refined	Cwt.	6.00— 6.50
Sodium Sulphate (Glauber's Salts) crystals,		
	Per Cwt. in Bags	.. — 2.10
	Per Cwt. in Car Lots	.. — 1.70
Sodium Sulphite	Lb.	.. — .05
Sodium Prussiate, Yellow	Lb	.19— .2
Sulphur, ground	100 Lb.	2.75— 3.25
Sulphur, roll	100 Lb.	4.50— 4.75
Sulphuric Acid, 66 Be, carboys.	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars		.. —24.00
Talc, No. 1 grade	Ton	.. —33.00
Talc, No. 2 grade	Ton	.. —28.00
Talc, No. 3 grade	Ton	.. —21.00
Tin Chloride crystals	Lb.	.30— .35
Tri-sodium Phosphate	Lb.	.08½— .09
Ultramarine, Blue	Lb.	.15— .35
White Precipitate (Mercuric Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	.. —30.00
Whiting (American)	Ton	.. —30.00
Zinc Sulphate, com.	Lb.	.05¾—.06½
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.9½—.10½
Zinc Stearerate	Lb.	.. — .75
Sodium Silicate, according to density	100 Lb.	3.00— 3.50
Sodium Nitrate, crude, 95%	Cwt.	5.00— 5.75
Sodium Nitrite	Lb.	.12— .15
Sodium Peroxide, f.o.b. New York	Lb.	.30— .35

Organic.

Acetanilid, C. P.	Lb.	.45— .50
Acetic Acid, glacial, carboys, f.o.b. Shawinigan Falls	Lb.	.. —.20½
Acetic Acid, glacial, bbls., f.o.b. Shawinigan Falls	Lb.	.. — .20
Acetic Acid, 28%, carload lots	Lb.	.. — .04
Acetic Acid, 28%, 25 bbl. lots	Lb.	.. —.04¼
Acetic Acid, 28%, 10 bbl. lots	Lb.	.. —.04½
Acetic Acid, 28%, 5 bbl. lots	Lb.	.. —.04¾
Acetic Acid, 28%, 1 or 2 bbl. lots	Lb.	.. — .05
Acetic Acid, 80%, carload lots	Lb.	.. — .12
Acetic Acid, 80%, 25 bbl. lots	Lb.	.. — .14
Acetic Acid, 80% 15 bbl. lots	Lb.	.. — .15
Acetic Acid, 80%, 10 bbl. lots	Lb.	.. —.15½
Acetic Acid, 80%, 5 bbl. lots	Lb.	.. — .16
Acetic Acid, 80%, 3 or 4 bbl. lots	Lb.	.. — .17
Acetic Acid, 80%, 1 or 2 bbl. lots	Lb.	.. —.17½
Acetone, pure, drums or over	Lb.	.. —.19½
Acetone, pure, lesser amounts	Lb.	.. — .25
Aspirin, in 100-lb. lots	Lb.	1.00— 1.10
Alcohol, Absolute Ethyl, case of 1 doz.	1-lb. bottle	.. — 2.15
Alcohol, Absolute Ethyl, in steel drums of 10 gallons capacity	Imp. Gal.	.. —15.00
Alcohol, acetone, bbls. or over	Gal.	.. — 1.35
Alcohol, acetone, lesser amounts	Gal.	.. — 1.60
Alcohol, pure, bbl., 65% O.P.	Gal.	.. —10.50
Alcohol, methylated, bbl.	Gal.	.. — 3.50

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TABLE OF CONTENTS

EDITORIALS:

Page
- The Business Outlook 99
- Consolidating the Effort 99
- The Case for Poison Gas 100
- Good Sound Sense 100

Plant of The Northern Explosives Co., Ltd., Dragon, Que., Description of. By J. R. Donald 101
New Uses for Rubber in the Paper Field 104
New Books 104
Building Queenston Generators 105
New Chemical Developments 108
The Relative Lowering of Vapor Pressure of Aqueous Solutions. By Maitland C. Boswell and R. C. Cantelo 109
Chemical Society News 111
Program of Ottawa Convention 111

Page
Canadian Chemists Represented at International Conference of Agriculturists 111
Report of March and April Meetings, Canadian Pacific Section, Society of Chemical Industry 112
Report of Ottawa Section, April Meeting 113
Spring Meeting of American Chemical Society 113
Personals 114
The Business Outlook 115
World Conditions and News in Chemical Fields 116
Mining and Metallurgy in British Columbia 117
Latest Chemical and Metallurgical Patents. By A. E. MacRae 118
Something New in Pumps 119
Mineral Production in Quebec, 1921 119
Industrial Items 119
Company News 120
Market Review 120
Buyers' Guide .... 55 Index to Advertisers 64

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CANADIAN INSTITUTE OF CHEMISTRY

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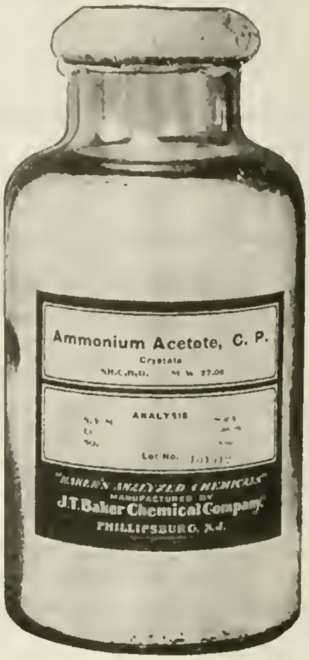

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EDITORIALS

THE BUSINESS OUTLOOK

SUCH general signs as the trend in steel activities, construction work, the stock and bond markets, money rates, even the Genoa Conference, are decidedly more hopeful. In America, there seems to be a movement of business which pays less attention to world politics and events than was the case during the last two years. We even refuse to become seriously alarmed at a national coal strike.

Events seem to indicate that the United States will pass still further restrictions and tariffs on imports. After all, there is quite enough business possible, if the public of that country establishes a buying and investing mood to create a very brisk boom. Exports are not an absolute necessity for good times where the buying unit is one hundred millions, and each citizen is trained to require the latest possible means of enjoying life.

The passage of such a bill may be the quickest way to produce new economic conceptions in that country. Should the gold reserve in the United States be put to work eventually, in foreign loans, and a new American vision arise of the place of the United States in general affairs abroad, there would result a continuation of the bright business outlook. Canada is so tremendously dependent upon the actions of the United States and Europe, in trade matters that we must be prepared for two alternatives. We must be able to do business either north and south, east and west, or both. The natural exports of Canada are necessities, and while cleverness and internal co-operation plus more active foreign representation are necessary, these resources are bound to demand attention.

There are still many ways in which Canadian manufacturers can expand internal business, and some important export opportunities are not being neglected—the West Indies for example. We are presenting some viewpoints elsewhere in this issue that are worth while when chemists are considering their position at a time of national convention. The business outlook in the main, is the outlook for the average chemist, and the bright spots are more numerous than they were a year ago. The situation is one which needs the active optimist. If the period is presenting any special opportunities they are for the engineer who can translate the scientific method of the laboratory and the plant to the study of sales and marketing. Most organizations dealing with technical products can yet absorb with good profit to themselves a few more broadly trained technical executives in sales marketing and trade development work.

CONSOLIDATING THE EFFORT

STEPHEN MIALL, who brings Chemical thought in England to the attention of America, through a monthly letter in the "Journal of Industrial and Engineering Chemistry," and whose knowledge and judgment is mature, reviewed recently the struggle for co-operation among the Allied Chemical Societies of England.

The aim is to so organize British chemistry, that chemists, as a whole, can make their voice heard and influence felt. In scathing terms, he outlines a situation which is general, and in no way confined to England. He says:—

> "The Chemical Society, the Society of Chemical Industry the Association of British Chemical Manufacturers, the Faraday Society, the Public Analysts, the Dyers and Colorists and the other societies have appointed representatives to form a Federal Council, which is gradually getting into working order. But it is too recent a creation to make its influence felt in government circles: otherwise the Safeguarding of Industries Act—so far as chemicals are concerned—would have been very different. This country professes to be a democracy disguised as a monarchy; it is in fact a bureaucracy mainly recruited from an aristocracy; the officials who do the actual governing are usually about as sympathetic to science as stockbrokers or brigadier generals. In Parliament, the men who understand chemistry and its needs could be numbered on one's fingers and most of these are naturally put into positions where their knowledge will not be liable to bias their views Thus Sir Alfred Mond, who knows a good deal about the chemical industry, is in charge of the Ministry of Health; if Sir Joseph Thomson or Sir Ernest Rutherford were successful politicians, we should probably find them Colonial Secretary and Director of Poor Law. The average politician seems to regard the chemist as something between an alchemist and a druggist—a clever crank, to be listened to with the courtesy the government official is accustomed to display, but who may be forgotten so soon as his back is turned. The Federal Council hopes that in time it may be able to keep the country on the right track in matters pertaining to chemistry."

Dr. R. F. Ruttan, President of the Society of Chemical Industry, speaking to Canadian chemists, points out what can be avoided here, and what has been avoided to date, namely, an undue splitting up of the ranks. When chemists in narrow groups, begin to seek general attention, or guide and influence affairs, a waste in effort results. No matter how far group ramifications may go, a central body is a necessity to the state.

Dr. C. K. Mees points to brighter times in the tone of his recent address. Industry will yet repay what she owes to science.

There is a general struggle going forward for the full and complete recognition by industry of her debt to science and research. What this may well mean to scientific workers within the next few years, no one can say; but, the chances are, that progress can be made best by complete national and international co-operation among trained men.

THE CASE FOR POISON GAS

THIS is because our little boy was wakeful. We read some of Joel Chandler Harris' delightful "Uncle Remus." Uncle Remus had his own story of the deluge. The animals had a convention, and all of them were present, even the crawfishes. The lion was in the chair, and the large animals were doing all the talking. The elephant coming forward to speak quite inadvertently stepped on a crawfish and smashed it. The other crawfishes had a meeting, drew up resolutions, with numerous "Whar fo's," but could not make themselves heard. Presently, the elephant moved again, and another crawfish passed into Valhalla. There was another meeting and resolutions, but with no better results. Finally the crawfishes started to bore into the earth until they bored into the water under the earth, and it came up and up and all the animals were drowned.

The big animals have decided to outlaw poison gas, but if the little animals are going to get smashed or otherwise maltreated without any attention being paid to their cause, it is not unlikely that they will resort to any mode of combat which gives maximum results with minimum expenditure. It will not be safe to abolish, on paper, the use of toxic gases for warfare until warfare itself is outlawed. The unscrupulous who stand in slippery places make nice of no vile hold to stay their footsteps. Since this is the case, it would be folly to relegate the study of poison gases to the background, and it seems an undue altruism that would refuse to collaborate with national authorities in the work. There is here as in the case of explosives a means of utilizing for industrial and humanitarian purposes the results of investigations carried on under national defense appropriations.

The proper study and application of poison gases may lead to the extermination of vermin, which now take an enormous toll of life and property.

A few days ago a band of criminals blockaded themselves in a house and swore that the first constable who approached was doomed. They were readily handled with a little tear gas.

Some branches of industry now take advantage of war experience in handling cylinders of chlorine gas for bleach, avoiding the transportation charges on casks of bleach powder. On the other hand, mine rescue work has the use of masks devised for defense from gas.

The most far-reaching investigations into the properties of matter and some of the most practical applications of science to industry are concerned with matter in gaseous form.

We live and move and have our being in a medium of gases.

By all means, let us learn all we can about gases, benificient or otherwise, and as more money can be earmarked for national defense than for conservation, let us get our conservation indirectly.

GOOD SOUND SENSE

MR. O. Eisenschiml, manager of the Scientific Oil Compounding Co., of Chicago, recently put before the Indianapolis Section of the American Chemical Society, what may yet be considered the "Declaration of Independence" of the American Chemist.

He is calling the bluff of every chemist, in a way that should at least stimulate some to action. Perhaps we may yet have a Union of Chemists, that will command and control both capital and labor. What an interesting prognostication!

At the same time, extracts from the address mentioned, are worth tumbling over in your mind.

"The United States to-day abounds in chemical knowledge. If the business men don't utliize it properly, the chemists themselves will."

"Chemical advice, dearly purchased and highly praised during the war, is now being shelved and disregarded. Perhaps it is only a coincidence that at the same time trade is stagnant, and our hold on foreign markets dwindling.

"Hundreds of chemists vainly looking for positions, will probably be forced to engage in business for themselves. Thus fate may push them into good fortune, and the skeptical business men out of it.

"All further talk about the good that chemists can do for manufacturers is wasted. A baker, refusing to take advantage of chemical knowledge, may some day wake up to find that a chemist has opened a bakery shop on the other side of the street. It may easily happen that he will be convinced and bankrupted at the same time.

"Chemical knowledge, like many other desirable goods, will not be bought by the public unless it is sold to them. Triumphant competition may eventually be the slogan of a successful although painful selling campaign.

"The kind of goods that sells on merit only, without selling effort, is yet to be found. Chemists have relied entirely on the merit of their goods, and have not sold them; manufacturers have refused

"If chemists have as much faith in their advice as they claim they have, they will stop fretting and fuming about the incompetence of business men; they will start to compete with the business men and show them how.

"The business men may have to worry about this, but the public won't. They will get their goods better, cheaper and more uniform than ever before."

Plant of the Northern Explosives Co., Limited, Dragon, P.Q.

Outline of Special Features and Design of Latest Nitric Acid and Nitration Equipment.

BY J. R. DONALD.[*]

THE Northern Explosives Co., Limited, of which Major G. C. Riley is Managing Director, has erected a plant at Dragon, P.Q., to produce standard grades of blasting powders, dynamites, and permitted explosives. The plant has been designed and erected under the supervision of the Managing Director, Major Riley, and of Mr. Hough, the well known consulting engineer, now of New York, and formerly of Canada. It is the first plant of its type erected under the Explosives Act, recently brought into force. It is, therefore, of particular interest to Canadians, having been built and designed by Canadians under Canadian regulations.

The site of the plant is that of the old Curtiss & Harvey establishment at Dragon, P.Q. The property consists of about 400 acres fronting on the Ottawa River and extending on both sides of the C.P.R. main line between Montreal and Ottawa. On this site have been erected the necessary buildings and equipment to make a complete plant for the manufacture of nitric acid, nitro-glycerin, straight dynamite, ammonia dynamite, gelatin dynamite, blasting powders, and permitted explosives.

South of the track is an attractive industrial village, complete with hospital, store, school, inn, and about thirty houses, with good roads, drainage, electric light, and pure spring water.

In addition to the well laid out houses, ball grounds and other facilities for amusement are provided. Between the main Montreal-Ottawa highway and the railway are the administrative building, chemical laboratory, change, lunch, and rest houses. North of the track are the factory buildings proper.

The topography of the property is particularly suitable to the erection of an explosives plant. A small hill, about the centre of the property, separates the red zone from the balance of the plant, and the red zone itself is well protected by the wooded nature of the land. A plentiful water supply is at hand, and in addition cold water is available in quantity from wells. This is especially valuable to a nitro-glycerin plant.

Outside the red area are found the following departments consisting of one or more buildings:

Power House.
Shipping Department.
Dope Mixing Department.
Shell Making House.
Acid Plant.

The power house and shipping department call for no special comment, except to point out that although the plant is connected up to hydro-electric power, they have an auxiliary steam plant. This guarantees the plant against sudden power stoppages.

The dope mixing department is well supplied with the necessary driers, mills and incorporators to efficiently handle the combustible and oxidizing ingredients of the dynamites.

Nitric Acid Plant and Sulphuric Acid Concentrators.

The nitric acid plant designed by Mr. Hough represents the latest developments in the manufacture and recovery of nitric acid. The plant is of the vacuum type and the first of its kind in Canada. Several of this type have been erected in the United States, but this plant has refinements which are the result of experience with the American plants. The whole system from the pot to the final absorption tower is under vacuum—the vacuum being supplied by a Nash Pump.

The still is of "Buflovak" cast iron set in the usual brick work with a thorough system of draft control which enables the temperature of the pot to be carefully regulated. As is usual with this Hough type of still, an agitator is provided, the various parts of which are so designed that they are quickly and easily replaceable. This agitator keeps the charge in motion, thus reducing local overheating and foaming to a minimum and resulting in an acid of high concentration containing a minimum of oxides. The sulphuric acid is not added at one charge, but gradually. From the still the acid passes through duriron water-jacketted condensers and then through earthenware condensers having a total length of about 300 ft. The vapors then pass to an absorption tower. Here they are absorbed in sulphuric acid and after passing through the pump are finally discharged through a sulphuric acid scrubber. The final outlet gases show only a trace of nitrogen oxides. The main feature of this system operating under reduced pressure, is the low temperature at which the sodium nitrate is decomposed, this resulting in a high yield of strong acid with a minimum of lower oxides. The fuel requirements are also low. It is claimed for this system that only 3% of the lower oxides are obtained. The efficiency of the plant is estimated at 99% of theoretical and 75% of the production should average 96% nitric acid and the whole 93 nitric acid. The plant will run four charges per twenty-four hours.

Acid Concentrator.

The sulphuric acid concentrator is housed in the same building as the nitric acid plant and possesses some novel features. The system consists of a short tower filled with spiral packing, connected to a cast iron concentrating pot. The whole is under a minus pressure supplied by a large exhauster. The incoming dilute acid passes down the tower where it meets the hot sulphuric acid and sulphur trioxide vapors from the pot, absorbing these and at the same time being partially concentrated. This acid then passes into the pot. The pot is set in a brick casing and heated on all sides from the Dutch oven immediately in front of it. The flue gases, however, do not come in contact with the acid. The acid in the concentration pot is agitated by a current of hot air which is pre-heated by an exchanger deriving its heat from the flue gases of the Dutch oven. This current of air keeps the acid in the concentration pot in rapid agitation, thus assisting the concentration and preventing a sediment of sulphate coating the sides and bottom of the pot. Prevention of the sulphate sediment assists the heat transfer to the acid and eliminates overheating and cracking of the pot. The pre-heating of this air also increases the thermal officiency of the installation. As a further aid to thermal efficiency the ingoing dilute acid passes through a heat transfer obtaining heat from the outgoing concentrated acid. The unit has a capacity of ten tons per twenty-four hours.

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[*] Consulting Chemist and member of the firm of J. T. Donald & Co., Ltd., Montreal.

Red Area.

The red area, as has already been pointed out, is separated from the safety area by a natural rise in the ground. In this area are found the nitrator unit, denitrator unit, three dynamite lines and the storage. The dynamite lines are laid out at right angles to the other units. The whole has been planned out by the designers in conjunction with the Chief Inspector of Explosives.

Every building in the red area, and in fact every part of the plant, is served by a 36″ gauge light railway which connects with the main C.P.R. line. An electric locomotive equipped with Edison storage batteries is used, and the line is laid out with easy curves and the grades so handled that a runaway truck is a practical impossibility along the line. Board walks are provided connecting all the buildings, so that the minimum of dust or dirt is encountered.

The following brief description of a typical building will, it is thought, be of interest here. The official license from Ottawa calls for: "Lightly constructed of wood, lined throughout with closely joined tongue and grooved square edged wood. Floor, closely joined wood covered with rubberoid up to about 18″ inside walls. Roofs—lightly constructed of wood covered with metal shingles. Track shed lightly constructed of wood studding covered with corr. iron." Each building in the red area conforms to the specifications of the Explosives Division, Ottawa. Further notable features are the following:

Wooden rails by each building; doors opening outward; no steel locks, catches, window fasteners; rubberoid covered floors with this material coming well up the walls; all corners rounded, to prevent any collection of dust.

An interesting feature is that each working building is provided with a semi-clean area, or change platform, through which everyone must pass when entering or leaving the building. Ample provision has been made for safety shoes, clothing, etc. Each building is devoted to one operation, and all the buildings are separated one from the other as called for by the "Table of Distances," and are further protected each from the other by the wooded nature of the land.

An independent heating unit has been worked out for each building which does away with all metal in the working buildings as well as all inter-connecting pipe lines. Each unit is housed in a building of its own close to the

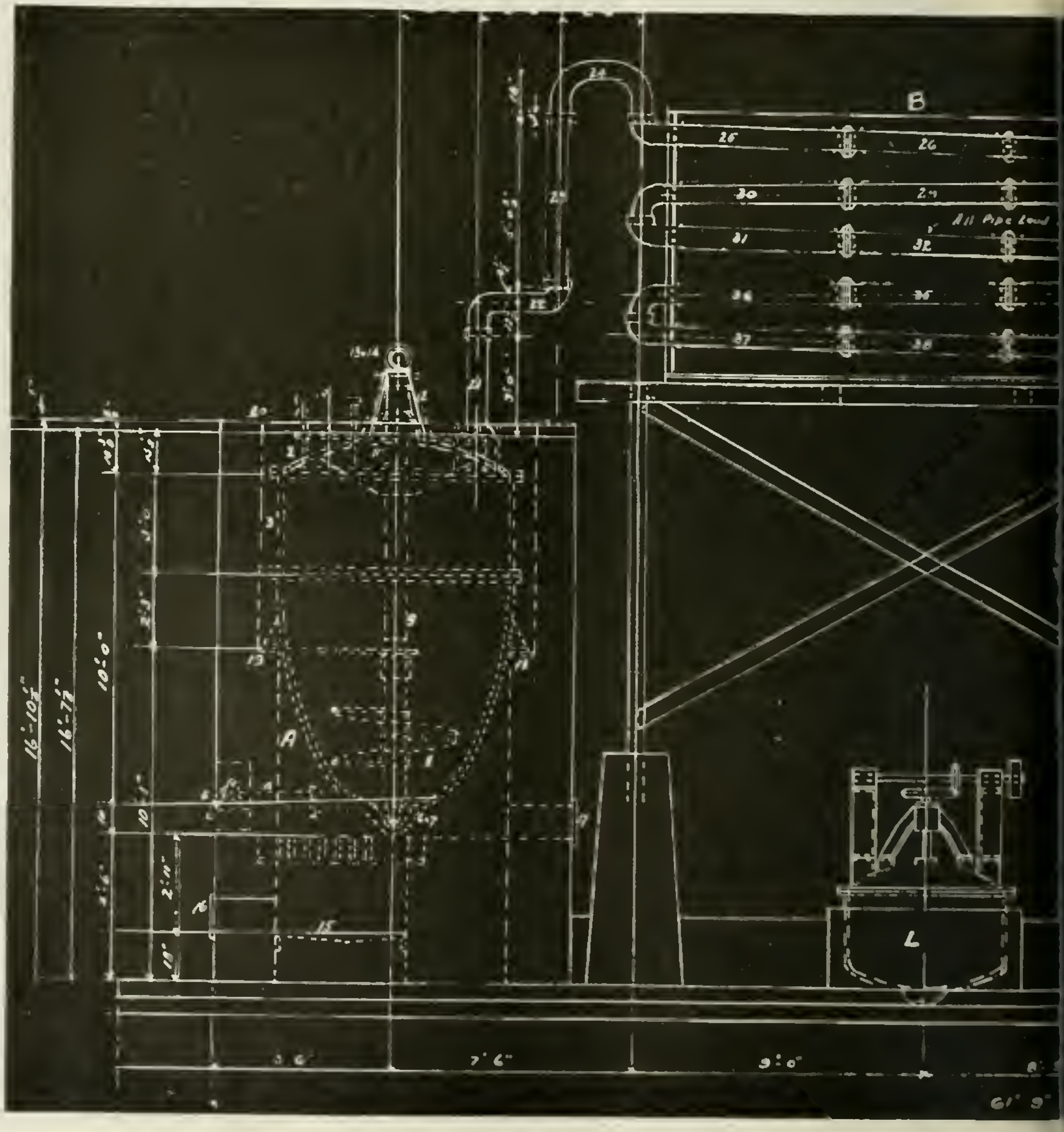
PARTS ILLUSTRATED

A—Still.

B—Condenser.

C and D—Earthenware Receivers.

E and F—Reflux Coils (Earthenware).



GENERAL ARRANGEM

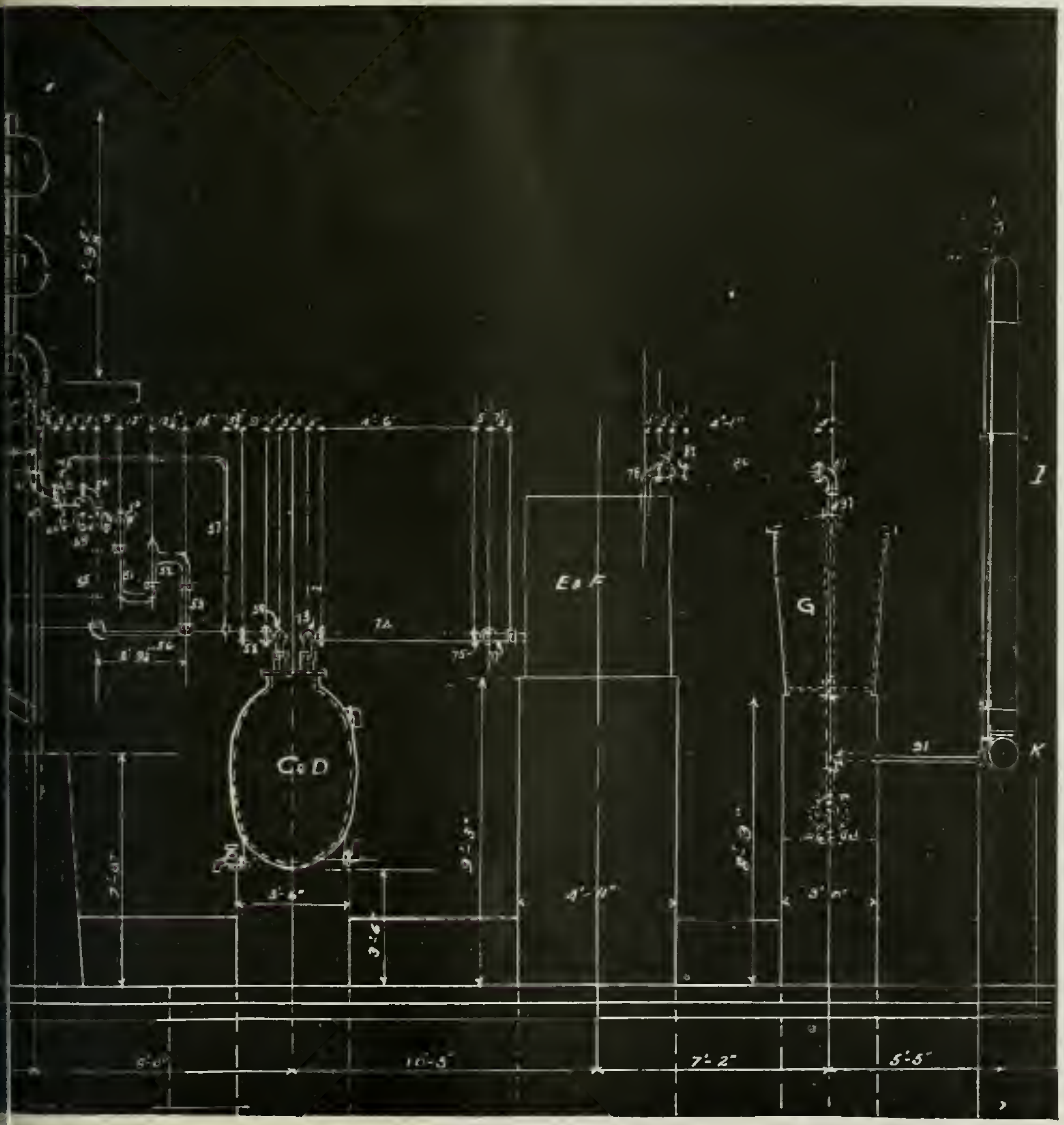
working room to be heated. It consists of a Taylor Forbes water-jacketted heater, contained in a room by itself. The radiators are in another room and consist of a stack of "Vento" coils. These coils are jacketted, and the air intake end screened. The air is sucked through these coils and gently blown into the working room by a "Keith" fan. The air ducts in the working room are so designed as to prevent any dust being raised or to allow any particles of what might become explosive matter to get into the air chamber. Glass windows are provided in the air ducts, for inspection and cleaning. An additional advantage of this system is that the working building is both heated and ventilated, ensuring the most healthful possible working conditions.

Nitration Unit.

The nitration unit is built into the side of the hill and surrounded with a barricade. The nitrator is of the Hough type, equipped with an agitator. The cooling surface is very large and the cooling water is sucked through cooling coils instead of being pumped through under pressure. With the cold water available a charge should be nitrated in about one hour in hot summer weather. In the event of leaks in the cooling coils the acid finds its way into the cooling coils mixing with the water there, instead of the water finding its way into the nitrator, as would be the case if the water in the cooling coils was under pressure. This is a very real advantage. As a further precaution each series of cooling coils in the nitrator is equipped with an electric indicator, indicating the presence of acid in the cooling water. The indicator is on the cell principle. If the conductivity of the outgoing water increases owing to the presence of acid the danger sign shows on the indicator. The glycerin line to the nitrator is supplied with an automatic valve which closes at once if the power, and consequently the agitation, ceases. The unit is also equipped with the usual drowning tank of large dimensions.

Denitration Unit.

Contrary to existing practice in this country, prior to the formation of the explosives division, the denitration unit is in the danger area. This is regarded as a distinct safety precaution in that explosions in denitration units handling spent nitro-glycerin acid are not unknown. This unit was also designed by Mr. Hough. The unit consists of a tower filled with spiral packing connected with the usual condensers and absorbers. Superheated steam enters at the bottom of the tower below the acid levels, bubbles through the denitrated acid and melts the incoming spent acid trickling down the tower. The spent acid enters the tower



G—Scrubber.
H—Nash Pump.
I—Absorbing Tower.
K—Circulating Pump.
L—Semi-Mix.

CUUM NITRIC ACID PLANT.

about one-third of the distance from the top. Introducing the acid below the top of the tower is a safety precaution which insures the breaking down of any nitro-glycerin which is present in the spent acid before the nitro-gycerin has a chance to distill out of the tower into the condensers. From the tower the nitric acid and oxides pass to the condenser and absorbers. The denitrator tower is lagged to prevent unnecessary heat loss and to facilitate regulations of the temperature in the tower. The acid from the denitration unit returns to the acid department. By the use of superheated steam and the careful regulation of temperature in the tower Mr. Hough claims to be able to obtain stronger acids in his recovery than is usual in most systems.

Dynamite Lines.

The dynamite lines contain the usual and necessary equipment for the manufacture of the various forms of dynamite. The different units are well separated and the different operations are localized in individual buildings.

The magazine, located a distance from the rest of the plant, connects with the dynamite lines and the shipping department by means of the light railway.

We have endeavored in this article to set forth some of the more interesting features of this latest of Canadian explosive plants.

The thanks of the writer are especially due to Major Geo. C. Riley, managing director; Mr. A. Hough, consulting engineer, and Col. G. Ogilvie, C.M.G., for the information they have placed at his disposal. The writer's thanks are also due to the directors of the company, who have permitted the publication of this article.

NEW USES FOR RUBBER IN THE PAPER FIELD

F. Kaye, of the College of Technology, Manchester, has opened up a new field for rubber. When rubber latex, suitably diluted, is added to the beaten pulp in the paper machine, and after thorough mixing, is afterwards, if necessary, thrown out on the fibres by a suitable coagulative agent, the rubber becomes as closely associated with the fibres as would be the case with a dye or an extremely attenuated rosin size.

Experiments show that the hydration of the fibre is modified and stimulated by the rubber latex. Research in this direction is still under way. Rubber so precipitated, has no deliterious effect on the color or finish of the dried paper. Experimental evidence of this has been collected for cotton, linen, bleached sulphite, bleached esparto, straw, and bamboo. Paper so treated, is improved in texture, and more uniform by transmitted light.

The use of rubber latex in small quantities, lowers the time of beating necessary to produce a given strength. A pulp beaten two to two and a half hours may become as strong as one beaten three and a half to five hours without rubber. Tensile strength, bursting strength, and folding resistance are increased. This latter property is of very special importance. Loading material, such as china clay, is better retained, and the water-repellent power increased. A saving in the amount of dye necessary for colored sheets results. On a long series of tests made, the increase in folding resistance was never less than ten times, and often much greater. With rubber at 36 cents, the cost of paper containing 0.5% rubber would be $5 to $9. The cost of production will be less.

Linoleum Substitutes

By using mechanical wood, waste paper and other fibres with loading materials and increasing the quantity of rubber latex, a very good and cheap linoleum substitute can be made. Machines are being made to produce these in colored designs. Several English mills are working on a commercial basis producing and testing this latex paper.

NEW BOOKS

"A COMPREHENSIVE TREATISE ON INORGANIC AND THEORETICAL CHEMISTRY"

By J. W. Mellor

Longmans, Green & Co., Vols. 1 and 2, 1050 and 900 pages. Price, $20.00 per volume.

Chemists and those only indirectly interested in chemistry must unconsciously approach a work of this kind with a feeling of deep respect for the concentrated, diligent, time-consuming effort put into its production. What industry, the art of teaching and research owes to such standard records will remain unmeasured. Of this treatise two volumes are now available and it is understood that several further volumes remain to complete the work.

A logical development has taken place in books of this type. We have passed through a century of dictionaries, as far as original material in English is concerned, from the time of Nicholson's "Dictionary of Chemistry" (1798-1808) to Thorpe's "Dictionary of Applied Chemistry" (1890-1892 and the 1921 edition).

Mellor evidently believes that chemistry as a science has advanced beyond the dictionary method of arranagement and that now a more clearly knitted presentation of known theory and proven data can be presented safely with some hope of attaining permanent value. In order that no misunderstanding should result, it must be clearly stated that the scope of this work includes a complete description of all the compounds known in inorganic chemistry and a thorough development of all the laws of physical chemistry which go to make the subject a mathematical science.

Physical contestants and innumerable references to early literature are given. The impossible has not been attempted, namely a complete detailed account of either all methods of manufacture or all technical uses. At the same time, the amount of space given to industrial processes is relatively very large and sufficient for a first reference at least in all cases.

Volume 1 is mainly historical and introductory. It covers the development of research from early times and includes in detail hydrogen and oxygen. Volume 2 methodically covers in great detail the elements F., Cl., Br.1., Li., Na., K., Rb., Cs. and all their compounds.

Following the text, a complete reference in many cases to hundreds of articles, makes the work the equivalent of a classified index to world literature. As the basis of a library, the work is most worthy and comprehensive, and the chemical profession will remain greatly indebted to the author for no short period.

"ZIRCONIUM AND ITS COMPOUNDS

By E. P. Venable

Chemical Catalog Co., New York. 170 pages. Price $2.50.

This book is a monograph, bringing together references, patents and bibliography on zirconium, and discussing known properties and uses. The compounds of this element with both inorganic and organic elements and radicals are given in great detail. There is a chapter on analytical methods and also one on the technical application of zirconium. A most valuable and handy record on this element.

PULP AND PAPER PROGRESS

Canadian paper exports for March, amounted to 1,903,930 cwts. newsprint, being an increase of 388,945 cwts. over March, 1921. This is a new high record. The value is slightly less, amounting to $10,673,332 for 1922, and $12,407,476 for March, 1921. Pulp exports increased in volume and value. The volume increased by 586,138 cwts., and the value $592,5[illegible].

Building Queenston Generators

Details of the Manufacture by the Canadian Westinghouse Co. of the Largest Generators of This Type Ever Erected to Date.

IN recent years, Hydro-electric development in Canada has made very rapid progress. The large amounts of water-power available in various places throughout the Dominion have led to the development of very large units for the generation of electrical energy, which is being transmitted to and consumed in the industrial centres. It is the object of this article to give a general description of one of these large generating units which for some time has been operating successfully.

Located in the Queenston generating station of the Hydro-Electric Power Commission of Ontario, there is in operation one of the 45,000 Kv-a (55,000 H.P.), 3 phase, 25 cycle, 12,000 volt, alternating current generators built by the Canadian Westinghouse Company, Limited, Hamilton, Ontario, for the Commission. The generator is coupled directly to a 55,000 H.P. Wellman-Seaver,Morgan water turbine. While this generator is only one of a number of units of equivalent output

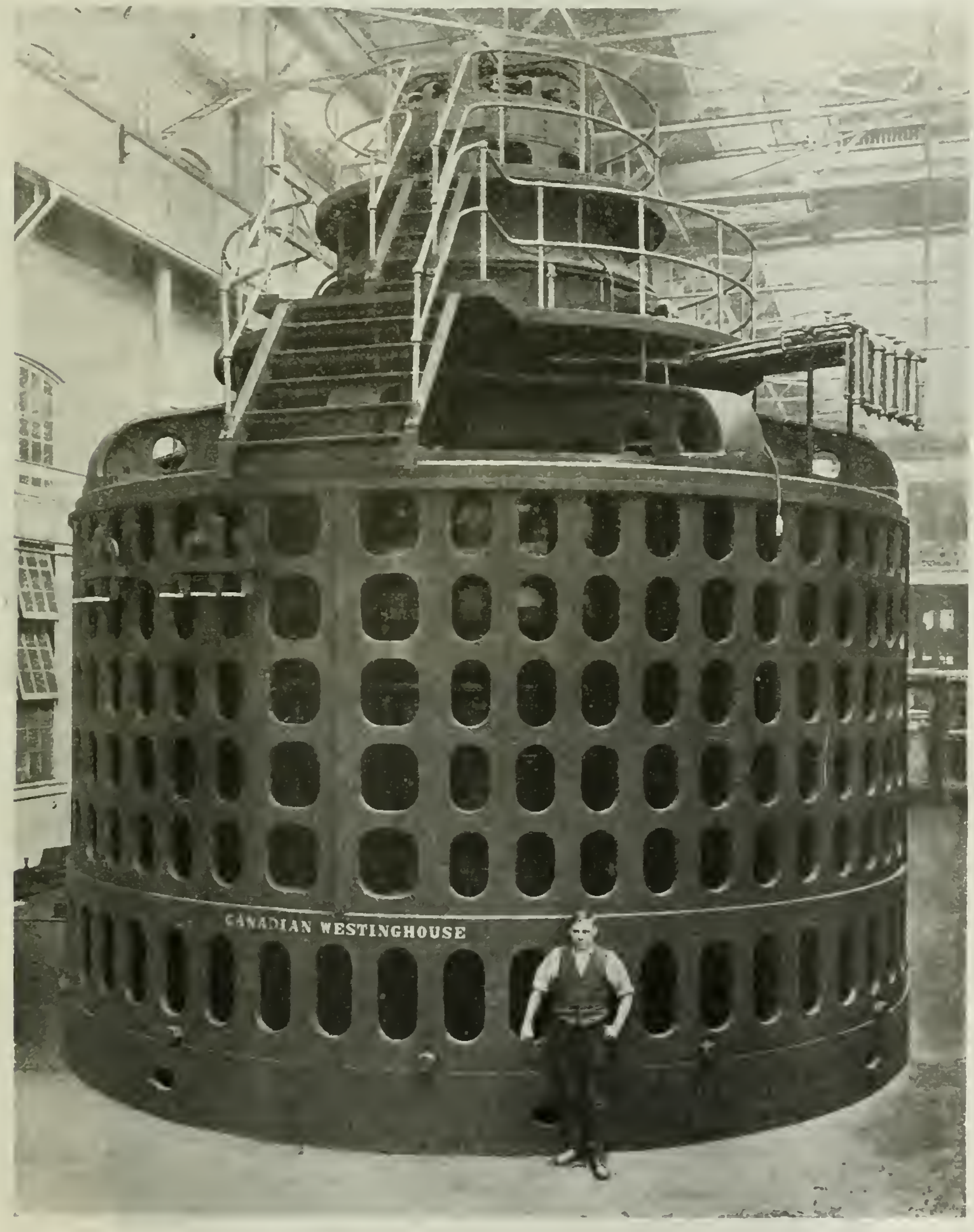


Fig. 1—45,000 KV-a (55,000 H.P.) Queenston Generator.

being installed in the same station, it has the distinction of being the largest of its kind in operation at the present time, not only in Canada and the United States, but in the whole world.

The generator to which reference has been made above is of the vertical type with direct connected exciter which is mounted above the generator, as will be seen from the illustration (Fig. 1) herewith. The driving turbine is directly underneath the generator. Between the generator and exciter is located the thrust bearing which carries not only the weight of the complete rotating element, but also that due to the water thrust on the turbine. The guide bearings at the upper and lower ends of the generator maintain a uniform clearance (or air gap) between the rotating and stationary parts.

Stationary Part

The stationary part, or stator, of the generator comprises a number of integral parts each bearing a definite relationship to the others. Of these parts the frame is one of the most important since it carries, directly or indirectly, all the other parts.

The frame is in the form of a webbed annular ring, and is made of cast iron. By reference to Fig. 1, it will be seen that in the outer part there are numerous openings which serve as outlets for the air forced through the generator for cooling purposes. Inside there are heavy axial or cross ribs, the inner surfaces of which are machined and have dovetail slots for holding the armature punchings cut in them. The cross ribs are braced by circumferential ribs uniformly spaced along the cross ribs. Due to the large size of the frame for this machine, it was found advantageous to divide it into a number of parts arranged for bolting together to form the complete unit. By the first division, a lower and an upper frame are provided. The lower frame rests on the bedplate and carries the lower bearing bracket with the lower guide bearing. This part of the frame is divided radially into two equal parts. The upper frame is supported by the lower frame and holds in it the armature core and windings while on top it carries the upper bearing bracket which in turn supports the exciter, the upper guide bearing and the thrust bearing. This part of the frame is divided radially into four equal parts, the joints being made in the centres of cross ribs to facilitate belting the sections together. Some conception as to the magnitude of this frame may be had from the fact that the approximate dimensions of each section of the upper frame are 10 feet in height and 19 feet in length while the weight of each section is 42,000 pounds, approximately.

The armature core is built up of thin sheet steel laminations which are punched to exact size. Due to the large diameter of this machine segmental punchings are used, having on the outside, dovetails for holding them in place in the frame, while on the inside are the slot openings into which the armature coils are inserted. After being punched to size and before being assembled in the frame, these segmental punchings are annealed and enameled, a coating of enamel being put on both sides of each punching. In building the armature core from these punchings, vent ducts spaced about two inches apart, are put in between the layers and extend all around the core. The punchings after being stacked in the frame, are drawn tightly together under pressure and held firmly by means of heavy cast iron end plates which are keyed to the frame, in addition to being braced by heavy bolts which extend from one end plate through the punchings to the other end plate. These through bolts are insulated from the punchings. Fig. 2 illustrates the assembly of the frame and armature core, one quarter section being removed.

Armature Winding and Coils

The armature winding of this generator consists of a large number of coils formed to shape and thoroughly insulated for insertion into the slots in the core. Bare copper strap rectangular in section, is used in making the coils, there being a number of straps used to make up each conductor. After the coils are formed to shape, the individual straps and also the groups of straps forming the conductors are insulated from each other by taping over all with mica tape. In insulating the complete coils, micarta folium insulation comprising a process patented by the Westinghouse Company is used. This insulation consists almost entirely of mica and in applying it to the coils precautions are taken to see that the layers are drawn tightly together in order to eliminate air spaces between the layers. The result is an insulation which is not only very compact, but also one which has a high dielectric strength. It will readily conduct heat away from the coils and at the same time will withstand high temperatures without deterioration, thus giving an insulation which is practically indestructible under all conditions of operation. One of the armature coils completely insulated in this eay is illustrated in Fig. 3.

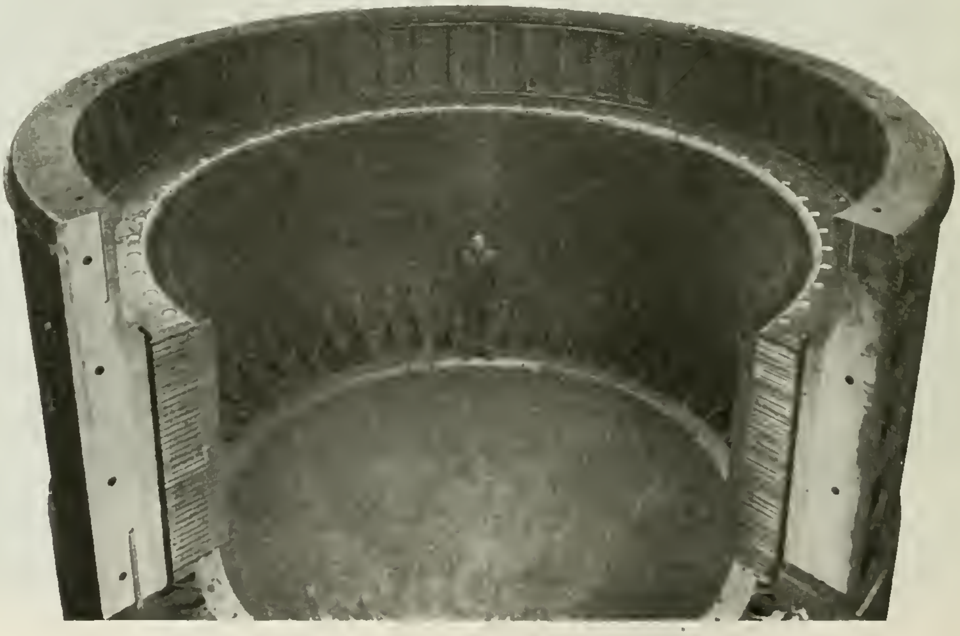


Fig. 2—Frame of Generator with One-quarter Section Removed.

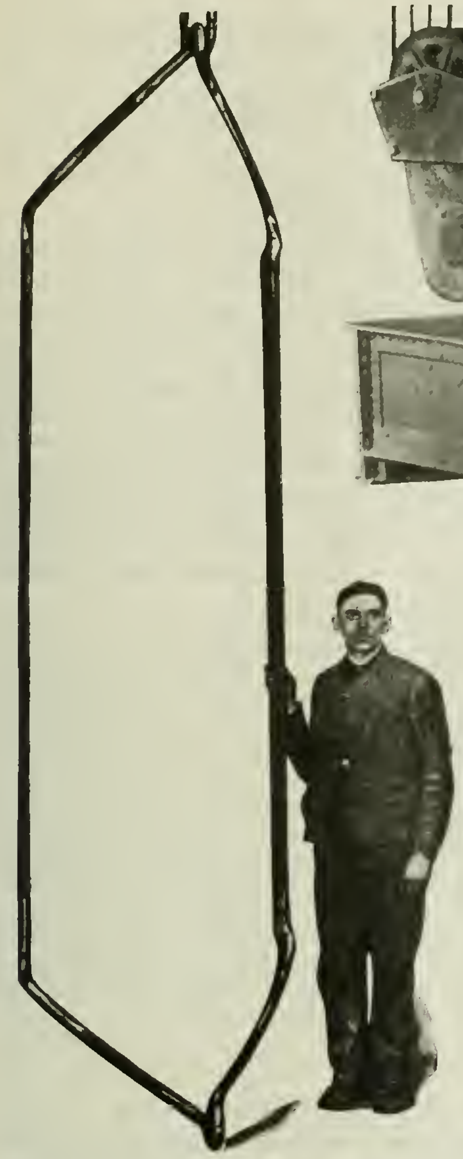


Fig. 3—Armature Coil of Queenston Generator.

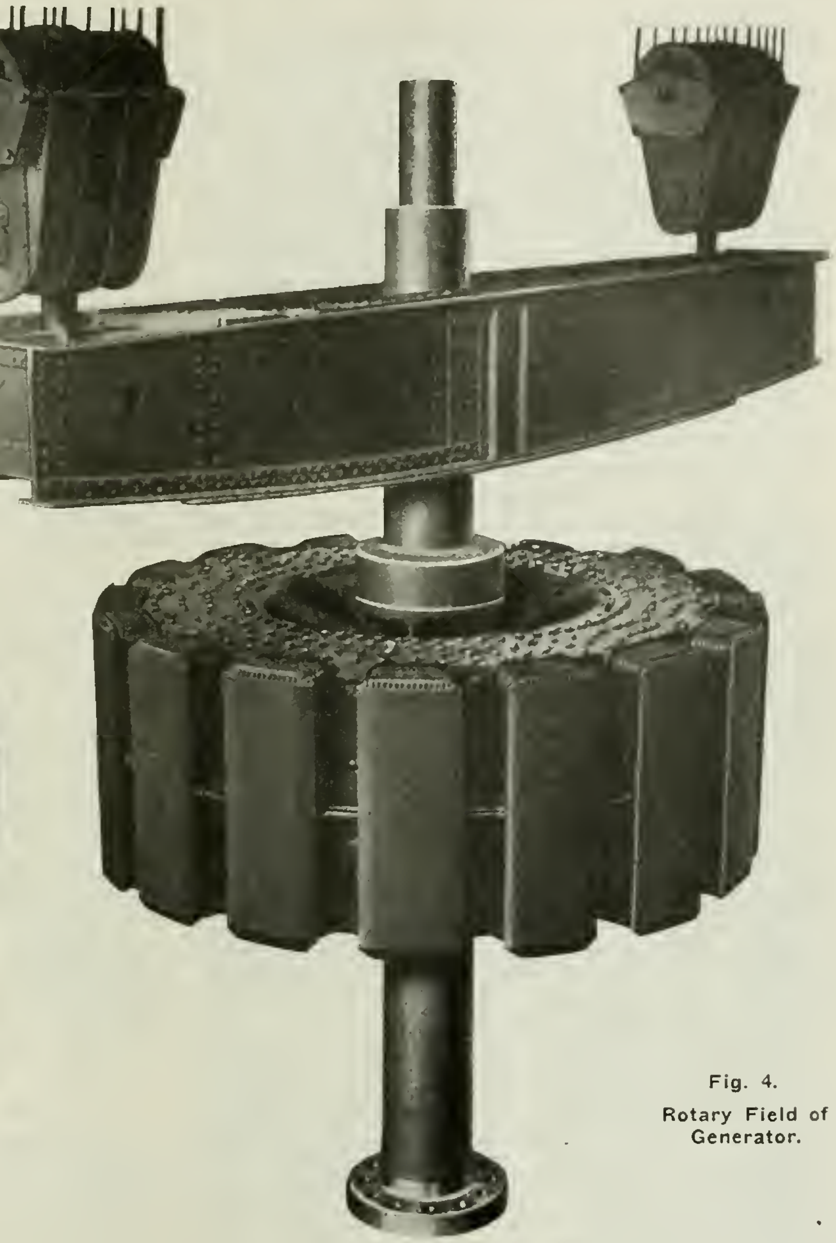


Fig. 4.
Rotary Field of Generator.

Slot cells are used to protect the surface of the insulation from the iron and at the same time they serve as wedges to make the coils fit tightly in the slots. The coils are retained in the slots by fibre wedges fitting into grooves in the sides of the slots. The ends of the armature coils are braced similarly to those of turbo generators. There are cast iron coil supports bolted to the end plates and to these the coil ends are fastened by means of wooden blocks placed under, between and above the coils. Insulated bolts extending through the openings in the ends of the coils to the cast iron coil supports hold the wooden blocks rigidly in place.

The connections between the various parts of the winding are made of insulated copper straps carried on supports above the upper ends of the coils. The windings are arranged for star connection and both ends of each phase winding are brought out through the frame in order that protective relays may be inserted in each circuit, while between coils in the slots, a number of thermocouples are distributed throughout the winding for checking the temperature of the various parts of the winding.

Bearings

The upper and lower bearing brackets are each made in the form of a spider having the arms heavily webbed for strength and rigidity. Cast iron is used for these brackets since it is more rigid and subject to less deflection than cast steel for equivalent strength. The brackets are each made in two sections, being divided radially through the hub. The surfaces at the intersections are machined and the two sections are bolted rigidly together. The approximate weight of the lower bearing bracket is 45,000 pounds, while that of the upper bracket is 80,000 pounds.

There are three bearings in connection with the generator, the main one of which is the sixty-nine inch Kingsbury thrust bearing carried on the upper bearing bracket. This thrust bearing is designed to carry a load of 1,000,000 pounds, including the complete rotating element together with the water thrust on the turbine. The rotating part of the bearing consists of a cast iron collar carefully surfaced on the bearing side and fastened to the shaft. This collar is supported by babbitt-faced segmental steel shoes which are pivoted so that they can rock in any direction a limited amount. The complete bearing is immersed in oil which is kept cool by use of copper cooling coils through which water is circulated to carry away the heat generated in the bearing. A means of circulating the oil is also provided. This is a well-known type of thrust bearing, having proven satisfactory in many large Hydro-electric installations, and is highly favored on account of its low friction loss.

Two guide bearings are used in connection with the generator, one of which is placed above the rotating field and mounted on the upper bearing bracket below the thrust bearing, while the other is below the rotating field and is mounted on the lower bearing bracket. The bearing housings are made of cast iron, arranged with water jackets through which cooling water is circulated. These bearings are lined with babbitt of high grade, having numerous grooves for carrying the oil to all parts of the bearing surface. The oil is forced through these bearings by means of pumps.

Underneath the lower frame and supporting the complete generator is a circular cast iron bedplate made in halves which are bolted together. The top of the bedplate is machined so that by means of adjusting screws the proper alignment of the generator can be obtained. Heavy foundation bolts are used to hold the bedplate firmly on its foundation.

Rotating Part

The rotating field, illustrated in Fig. 4, consists of laminated field poles on which are mounted the field coils. The poles are attached to a spider mounted on the shaft.

The laminations for the poles are punched to size from sheet steel, and are held together by heavy plates at each end, together with long rivets extending through the punchings between these end plates. The poles are dovetailed to the rim of the spider, and are held in place by means of two tapered steel keys driven into the slots beside the dovetail of the pole. In making the field coils, heavy bare copper strap is used which is formed to shape and then insulated. Sheet asbestos and shellac are used in insulating between turns while on the inside of the coils, adjacent to the poles, and also on the upper and lower edges of the coils, insulation consisting of mica, asbestos and bakelite is built up and moulded to size and shape. The coils completely insulated in this way are baked to consolidate the insulation. Heavy insulating washers placed at the top and the bottom of the coils protect them from the iron of the supporting pole tips, and also from that of the spider rim. They also act as wedges holding the coils tightly in place.

The yoke of the rotating field is formed by the rim of the spider on which the poles are carried. Although the peripheral speed of the spider is not excessive, a laminated steel rim is used, the uniformity of the material for which being much more certain than that for cast steel. The rim punchings have dovetails on the inside for mounting on the cast steel hub of the spider and dovetail slots on the outside for holding the poles. Cast steel end plates bolted through the punchings support the laminated rim. The hub of the spider is a steel casting made in the form of a webbed spider of comparatively small diameter. Dovetail slots are cut in the outer surfaces of the cross ribs to receive the dovetails of the rim punchings, while the inside is bored out to receive the shaft. Due to the length of this part, three machine fits are used on the inside to facilitate inserting the shaft. A heavy steel key prevents this hub from revolving on the shaft. On the lower side of this cast steel hub there is a brake ring to which air brakes mounted on the lower bearing bracket, can be applied in case of emergency. This cast steel hub weighs approximately 55,000 pounds.

The shaft used in this generator is hollow, there being a hole eight inches in diameter throughout, which gives a member of maximum strength for minimum weight. Through the portion of this hole between the spider and the cast iron collector rings mounted on the shaft above the thrust bearing, the leads from the generator field to the collector rings are carried. This hole is also useful when it is desired to remove the runner of the water turbine without taking out the rotating part of the generator, since cables can be let down from the crane above the generator through this hole, to support the runner when the shaft is disconnected at the coupling between the generator and the turbine. A heavy cast iron collar keyed to the shaft at the upper end and held by means of a large steel nut, is used to support the shaft together with its impressed load, on the thrust bearing. The shaft of the generator alone is approximately thirty feet in length when measured from the face of the coupling to the top of the thrust bearing and is thirty-two inches in diameter inside the cast steel hub of the spider. Its approximate weight is 70,000 pounds.

Forced ventilation is used to keep the machine cool. Free air is drawn up from underneath the generator some of which passes through the spider to the upper side of the rotating field. Vane blowers attached to the spider distribute the air uniformly to various parts of the generator from which it passes through the various ducts in the iron and openings in the coils and the frame to the space between the generator and walls of the pit in which the generator is mounted, whence it is drawn by an exhaust fan. Openings in the generator leading to the generator room above, in which is located the upper portion of the machine, consisting of the thrust bearing and exciter, are closed by means of sheet steel covers so that the heated air does not pass up into the generator room. The quantity of free air passing through generator is approximately 120,000 cubic feet per minute.

When it is realized that this generator as completely assembled is approximately thirty-five feet in height from the face of the coupling to the top of the exciter, and 24½ feet in diameter, some conception will be conveyed as to the enormity of the generating units being built and installed in Canada at the present time. While the manufacture of these large generating units embodies only features that have proven satisfactory in smaller sizes, some of the outstanding features worthy of special note which have made feasible the development of large generators of the type described are (a) the rugged mica insulation adopted for armature coils, (b) the laminated steel construction of the spider rim, (c) the low friction losses in the Kingsbury thrust bearings, (d) the rigidity of cast iron utilized in making brackets capable of supporting heavy loads with a minimum deflection.—From the Engineering Department, Canadian Westinghouse Co., Ltd., Hamilton, Ont.

NEW CHEMICAL DEVELOPMENTS

The Canadian Salt Co. announces that they are immediately proceeding with their new chlorine liquefying plant. Their capacity will be ten tons per day. Mr. D. H. Pritchard, until recently superintendent of the entire electrolytic plants of the United Alkali Co., in England, has been appointed as works manager. He arrived recently from England to undertake his new duties.

The Pacific Color Manufacturing Co., of Chilliwack, B.C., announces that they are making lead chromate and Prussian Blue. They are also undertaking the manufacture of writing fluids and artists' colors. Their output at present is three tons per day.

The officers are: J. H. Campbell, President; H. Smartout, Vice-President; J. W. Gibb, Secretary-Treasurer.

MEETING OF INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

The third meeting of this body will take place at Lyons, June 27th to July 2nd. Canada and the Canadian Institute of Chemistry will be represented by Dr. R. F. Ruttan and Dr. A. T. Charron. The program calls for public receptions and industrial visits during the days of Convention. The various committees appointed to work on problems of international research, literature and the collection of scientific data, will report.

The Relative Lowering of Vapor Pressure of Aqueous Solutions*

By Maitland C. Boswell and R. C. Cantelo

Investigations undertaken for the purpose of determining the relation of solvent to solute, in the case of aqueous solutions of electrolytes and non-electrolytes, at concentrations up to saturated solutions, have been recently carried out in this laboratory, the results of which will be published in the near future. These measurements made it appear desirable to determine the nature of the curves obtained when the relative vapor pressure lowerings, calculated to equimolar concentration, are plotted against concentration. In this way it was hoped to secure additional confirmation of the correctness of our working hypothesis respecting the relation of solvent to dissolved substance, for high concentrations of the latter. The purpose of this paper is to describe our work upon the determination of vapor pressure lowerings by means of the air saturation method, and to describe a simple procedure for carrying out this determination with rapidity, and a satisfactory degree of accuracy. The interpretation and discussion of the results obtained will be reserved for the general paper.

Air Saturation Method

The air saturation method has already been applied in two ways—(1), by bubbling air through the liquid, and (2), by passing air over the surface of the liquid.

Regnault[1] determined the vapor pressure of water, by saturating a known volume of air with water vapor, by passing it through wet sponge and moist silk screens, the water vapor in the air, passing out of the apparatus, being determined by absorption in sulphuric acid and weighing.

In the Walker-Ostwald Method[2] air is bubbled through two Liebig bulbs containing the solution, then through one containing pure water, and finally through a U-tube containing pumice, soaked in sulphuric acid. From measurements of the loss in weight of the water bulb and the gain in weight of the sulphuric acid tube, the relative lowering of the vapor pressure of water by solution in it of the solute is calculated.

Will and Bredig[3] modified the method by using a nine-bulb Liebig apparatus and applied it to solutions in alcohol and ether.

Orndorff and Carrell[4] also used the method with alcohol as solvent, but their results, like those of Bredig, could not be said to be satisfactory. They found for example values from 63 to 79 for the molecular weight of phenol instead of the true value, 94. They suggest that probably the surface tension plays an important part in the method. Carveth and Fowler state that in one experiment, they found for the molecular weight of silver nitrate in anhydrous pyridine, the surprising result 17. To account for this, they say that it must be necessary to assume that there are disturbing factors of unknown value in the operation of the method.

Permann,[5] by bubbling a measured volume of air through a series of large Liebig bulbs obtained accurate values for the vapor pressure of water. Price and Permann[6] extended the method to water solutions of high concentrations, but the accuracy of their values for the vapor pressure lowering is doubtful, for Wood[7] by a static method and by a consideration of heats of dilution, showed that their error of measurement was large. Yet Permann had obtained accurate values for the vapor pressure of pure water.

Lincoln and Klein[8] and Krauskopf[9] passed a measured volume of air over the surface of a solution contained in a large tube which was kept in lateral motion. Their results appear to be quite accurate.

The Earl of Berkeley and Hartley[10] concluded that the failure of the original Walker-Ostwald Method was due to hydrostatic pressure variation in the several vessels. They also suggested that liquid was carried mechanically from the solution to the pure solvent. They accordingly applied the method by passing the air over the surfaces of the liquids contained in specially designed vessels, thus eliminating both sources of error. Their results are of a high degree of accuracy, but the time to complete a determination was about three days.

Derby, Daniels and Gutsche[11] determined the vapor pressures of pure alcohol and pure water by passing a measured volume of air through bulbs filled with beads, agitation being effected by rotating the apparatus.

Washburn and Heuse[12] measured the relative lowering of the vapor pressure for weight molar solutions of cane sugar with an error of less than 0.5%. They made use of specially constructed saturators and absorbers. Also they evaporated from 10 to 20 grams of water in an experiment, which required almost 24 hours to carry out.

This survey of the literature shows that the bubbling method gives values for the vapor pressure of a pure liquid which are as accurate as those obtained when the air is passed over the surface of the liquid, but that when applied to the determination of the difference in the vapor pressure of a solvent, and that of its solution, it is wanting in accuracy.

As there was no obvious reason for this inaccuracy, we decided to investigate further the method, and if necessary, apply corrections for pressure variations in the apparatus train. The simplicity and rapidity of the method were so desirable for our purposes that an endeavor to increase its accuracy appeared well worth while.

Development of Method Used

Vanier absorption tubes were used as saturators. When one of these is half-filled with water, and air is aspirated through, the air bubbles through a spiral containing the liquid, and then through a central tube also containing the liquid. There is excellent contact of air with liquid, and there is no danger of liquid being mechanically carried out of the tube. Two such tubes were connected in series and air aspirated through slowly. The loss in weight in the first tube was 0.4674g., in the second tube 0.0078g., indicating an unsaturation of 1.7%. Even when three tubes were used in series, the unsaturation amounted to 0.7%. The difficulty appeared to be in obtaining complete saturation of the air with water vapor.

We tried to eliminate this difficulty by using the train-water-bubbler, sulphuric acid driers, solution-bubbler, sulphuric acid driers. Now if M_w is the loss in weight of the water-bubbler and M_s the loss in weight of the solution-bubbler, and if the air leaving the water-bubbler and the air leaving the solution-bubbler are unsaturated to the same extent denoted by X, then the relative lowering is given by the expression $\frac{M_w+X-M_s-X}{M_w+X}=\frac{M_w-M_s}{M_w+X}$. Hence the value for the relative lowering actually obtained, $\frac{M_w-M_s}{M_w}$, would be too high. However, as X is small in comparison with M_w it was thought that this method might be an improvement on the former one. We applied it to a number of potassium chloride solutions and compared the values with those obtained by Lovelace and Fraser[13] by a very refined static method. The results show that the error for a twice normal solution is over 30%. This is the more remarkable, in view of the fact that our duplicate experiments agreed almost exactly, not only in the case of potassium chloride, but in the case of solutions of other salts. An experiment was made with water in both saturators. The value of $\frac{p_w-p_s}{p_w}$ was found 0.011 instead of zero.

Now Berkley and Hartley state that the errors of the original Walker-Ostwald Method are due, (1) to particles of fine spray being carried over from one bubbler to the next, and (2), to the difference in the hydrostatic pressure in the two vessels, so that the air although saturated in the first bubbler, expands in the second, and takes up more water vapor. The construction of the Vanier bulb precludes the possibility of the first error. In order to overcome the second one, we introduced small mercury manometers after the solution and water bubblers. The train now consisted of sulphuric acid driers, solution-bubbler with manometer, sulphuric acid driers, water-bubbler with manometer, sulphuric acid driers.

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* Contributed from School of Engineering Research, University of Toronto.

If v_1 is the volume of air passing the solution-bubbler, p_1 its pressure, v_2 the volume of air passing the water-bubbler and p_2 the pressure, then $p_1v_1 = p_2v_2$. If now p_s is the vapor pressure of the solution, p_w the vapor pressure of water, B the barometer pressure, S_1 the manometer reading at the solution-bubbler and S_2 the manometer reading at the water-bubbler then

$$p_1 = B - S_1 - p_s \text{ and } p_2 = B - S_2 - p_w.$$

Also the masses of water vapor required to saturate these volumes of air must be proportional to the partial pressures of the water vapor and to the volume of air or

$$\frac{m_s}{m_w} = \frac{p_s v_1}{p_w v_2}$$

From these equations the relation can be obtained

$$\frac{p_w - p_s}{p_w} = \frac{p_w(m_s - m_w) + m_w(B - S_w) - m_s(B - S_s)}{p_w(m_s - m_w) + m_w(B - S_w)}$$

Several experiments made with water in both bubblers showed a value $\frac{p_w - p_s}{p_w} = 0.006$ instead of zero.

The error is still too large, but has been lowered by approximately 50% by applying the correction for pressure variation.

Having by this time become suspicious that the degree of saturation of the air, depends on the particular bubbler used, different bubblers producing perhaps bubbles of different sizes and shapes, we accordingly made measurements inverting the order of the bubblers, and also introducing other Vanier tubes, and increasing their number, and found that the degree of saturation depends on the particular bubbler employed. As there is no doubt that the contact of air with liquid is equally good in all the bubblers, the cause for discrepancy must be sought in some other varying condition, as slight variation in the size of the bubble. It is probable that this variation, whatever it is, is a chief cause of error in all bubbling methods for determining relative lowering of vapor pressure, and that even with care to obtain sufficient contact of bubble with liquid, care to prevent mechanical carrying over of liquid particles, and care to make corrections for variation in hydrostatic pressure in the train, the bubbling method is still subject to an error so large and uncertain as to make it entirely untrustworthy. We accordingly turned to the second air saturation method of passing air over the surface of the liquid.

Method of Passing Air Over Liquid Surface

The method of Berkley and Hartley had the disadvantage that each determination of vapor pressure lowering occupied three days. Their saturators were arranged according to the original Walker-Ostwald Method. Also the method of Washburn and Heuse required an elaborate apparatus, and in it about 20 g. of water was evaporated in a single determination.

We have found that with the following simple apparatus, a determination can be carried out with a fair degree of accuracy in five or six hours, during which time, about one gram of water is evaporated. The saturators consisted each of a glass tube 20 inches in length, and ¾ inch diameter, closed at both ends, and provided with two glass tubes one inch in length, fused into the side, about ½ inch from each end of the main tube. One of these small tubes served as entrance tube for the air, and the other as exit tube. These exit tubes decreased in diameter from 3/8 of an inch where they were attached to the saturator, to 1/8 of an inch. These exit tubes were made as short as possible to minimize the error due to condensation of vapor on the glass surface[14]. A very small wash bottle served to indicate the rate of passage of the air, which was regulated so that about 1 gram of water was evaporated in 6 hours. The order of the train was sulphuric acid on pumice, solution-saturator, sulphuric acid on pumice, water-saturator, sulphuric acid on pumice. There was no pressure head in the sulphuric acid driers. The side tubes of these driers were bent so as to make a glass to glass contact with the exit tubes from the saturators. The whole apparatus was contained in an air thermostat, the temperature of which did not vary more than 1°C. The experiments were carried out at 23°C. In such a procedure a possible source of error, even though complete saturation is obtained in both saturators is the variation in the relative lowering of vapor pressure due to variations of temperature within one degree.

The extent of this error for solutions of moderate concentration can be calculated from a consideration of heats of dilution[16]. In the case of solutions of potassium chloride, and other salts, this error is small[15]. However, in the case of sodium and potassium hydroxides and sulphuric acid, all of which have large integral heats of solution, this error will be larger. While the equation for the temperature co-efficient of the relative lowering of the vapor pressure cannot be applied with accuracy to solutions of high concentration, yet in applying it, the order of the error caused by small temperature variations can be determined. On making this calculation for a solution of sulphuric acid, containing one mol of sulphuric acid per mol of water, it was found that the error in the relative lowering for a variation of one degree is about one per cent. For salt solutions and moderate concentrations of sulphuric acid and alkali hydroxide solutions, this error will be much smaller.

The error due to difference in concentration of surface and interior of solution will be much less than that due to change in concentration of solution by evaporation of one gram of water.

In order to test the accuracy of the method two series of experiments were performed. In one of these, water was placed in both saturators and the value of $\frac{p_w - p_s}{p_w}$ determined. The deviation of the value from zero is a measure of the inaccuracy of the method. In the second series the relative lowering for twice normal potassium chloride was determined and compared with the results of Lovelace and Fraser obtained by a refined static method.

In the first series, using water in both saturators, the values obtained for the relative lowering were 0.002, 0.001, 0.003, 0.003 for one gram of water evaporated. That is, the constant error for the method is .002. It should be pointed out that the percentage error in the value of $\frac{p_w - p_s}{p_w \times C}$ diminishes as the concentration increases, for the error is constant, the numerator of the fraction, (for equal amounts of water evaporated) increases as the concentration increases, while C also increases.

In the second series, the values found in the case of twice normal potassium chloride for the expression $\frac{p_w - p_s}{p_w} \times \frac{1}{C}$, where C is the normality of the solution, were 0.032, 0.032, which is in agreement with the value obtained by Lovelace and Fraser.

The following results were obtained where C represents the volume-normal concentration, m_w the gain in weight of the absorbers connected with the exit tube of the saturator containing water, m_s the gain in weight of the absorbers connected with the exit tube of the saturator containing solution.

C	m_w	m_s	$\frac{p_w - p_s}{p_w}$	$\frac{p_w - p_s}{p_w \cdot C}$
Potassium Chloride				
4.600	0.6430	0.5500	0.145	0.032
3.000	0.7368	0.6699	0.091	0.030
2.000	0.6948	0.6507	0.063	0.032
2.000	0.5512	0.5154	0.065	0.032
1.000	0.7002	0.6790	0.030	0.030
Potassium Iodide				
6.500	0.6856	0.4661	0.320	0.049
5.000	0.6616	0.5056	0.236	0.047
3.500	0.7554	0.6450	0.147	0.042
2.000	0.6188	0.5768	0.068	0.034
2.000	0.7540	0.7024	0 068	0.034
2.000	0.6714	0.6250	0.069	0.035
1.000	0.6550	0.6359	0.029	0.029
Cupric Chloride				
7.000	0.6538	0.5086	0.222	0.032
5.000	0.6947	0.5976	0.140	0.028
3.500	0.8280	0.7501	0.094	0.027
2.000	0.6692	0.6375	0.047	0.024
1.500	0.7333	0.7081	0.034	0.023
1.000	0.8282	0.8136	0.018	0.018
Silver Nitrate				
6.000	1.5456	1.3703	0.113	0.019
4.000	0.4064	0.3776	0.071	0.018
2.000	0.5624	0.5424	0.036	0.018
1.000	1.1669	1.1497	0.015	0.015
Sulphuric Acid				
30.000	0.9117	0.0075	0.991	0.033
23.800	0.7252	0.0534	0.925	0.039
16.700	0.9175	0.2405	0.738	0.043
13.700	0.3236	0.1398	0.569	0.042
10.900	0.6616	0.3989	0.382	0.036
8.100	0.6042	0.4329	0.284	0.035
6.200	0.9963	0.8095	0.188	0.030
4.200	0.6116	0.5532	0.096	0.024
3.000	0.5579	0.5198	0.068	0.023
2.100	0.5992	0.5723	0.045	0.021
0.950	0.7672	0.7523	0.019	0.020
0.470	3.8724	3.8448	0.007	0.015
Potassium Hydroxide				
14.700	1.7053	0.2049	0.880	0.060
12.500	1.8437	0.3382	0.817	0.065
10.200	1.4338	0.5082	0.645	0.063
9.400	1.9069	0.7461	0.610	0.065
7.100	2.1722	1.2956	0.404	0.057
5.300	1.1725	0.8320	0.290	0.055
3.600	0.8153	0.6802	0.160	0.046
1.800	1.2822	1.1926	0.070	0.039
0.930	2.5266	2.4575	0.027	0.030
Sodium Hydroxide				
16.300	0.9139	0.1274	0.864	0.053
12.500	1.1721	0.3533	0.696	0.056
10.100	2.4022	1.0806	0.550	0.054
8.500	0.5223	0.3058	0.423	0.050
4.200	0.4764	0.4023	0.156	0.037
2.100	0.6508	0.6077	0.066	0.032
0.980	0.9047	0.8820	0.025	0.026
Sucrose				
1.500	0.7334	0.7095	0 033	0.022
1.000	0.7856	0.7712	0 018	0.018
Pyrogallol				
3.500	1.2461	1.1662	0 064	0.018
3 000	0 7388	0.7000	0.053	0.018
2 000	1.1203	1.0864	0.030	0.015
Resorcin				
5.000	1.2042	1.1111	0.077	0.016
4.000	1.2792	1.2034	0.059	0.015
3.000	0.8764	0.8444	0.036	0.012
2.000	0.6189	0.6028	0.026	0.013

Summary

It has been shown that the bubbling method of air saturation for the determination of relative lowering of vapor pressure, is subject to errors which vary from saturator to saturator even though these are of the same type and of similar dimensions.

A simplified modification of the air saturation method by passage of air over the surface of the liquids is described, which gives fairly accurate results by the evaporation of about one gram of water, occupying about six hours.

Measurements of vapor pressure lowerings for solutions of potassium chloride, potassium iodide, cupric chloride, sulphuric acid, potassium hydroxide, sodium hydroxide, silver nitrate, sucrose, pyrogallol and resorcin are recorded.

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University of Toronto, April 10, 1922

ANNUAL CONVENTION OF CHEMISTS OTTAWA, MAY 15th, 16th and 17th, 1922

PROVISIONAL PROGRAMME

MONDAY, MAY 15TH—Registrations: Group excursions to Government Laboratories, The Mint, Experimental Farm, New Parliament Buildings, and other places of interest. The Associate Committee of Chemists of The Honorary Advisory Research Council will meet during the day. Meeting of Canadian Council of Society of Chemical Industry.

Meeting of Council of Canadian Institute of Chemistry.

TUESDAY, MAY 16TH—Annual Meeting of Canadian members of the Society of Chemical Industry; President's Address, papers and discussions, followed by a "Smoker," in the evening.

WEDNESDAY, MAY 17TH—Annual Meeting of Canadian Institute of Chemistry, Annual Dinner.

The Royal Society of Canada will meet in Ottawa on Wednesday, Thursday and Friday of the same week, and members of the Society of Chemical Industry and Canadian Institute of Chemistry will be welcomed at the scientific meetings.

A local committee of ladies will arrange for the entertainment of ladies accompanying visiting members.

CANADIAN CHEMISTS WILL BE REPRESENTED AT INTERNATIONAL MEETING OF AGRICULTURISTS

Canada is to be represented at the International Conference of World Agriculturists, which is to be held in Rome next month, by Dr. A. T. Charron, M.A., D.Sc., Chief Chemist and Director of the Dairy School of the Province of Quebec at St. Hyacinthe, Quebec, and W. E. Wilson, formerly Provincial Dairy Commissioner for the Province of Saskatchewan. Dr. Charron has been closely connected with agriculture in Canada during the past twenty-five years.

Dr. Charron has also been appointed official delegate of the Canadian Institute of Chemistry to the International Conference of Pure and Applied Chemistry, which will bring together, during the last week of June in Lyons, France, the principal authorities in chemistry from all over the world. This International Conference of Chemistry is of great importance towards the unification of analytical methods and co-ordination of research work in pure and applied chemistry.

Dr. Charron and Mr. Wilson sailed for the Conference on the Canadian Pacific "Empress of Britain" from St. John, April 22nd.

"On the 8th of May, the agricultural authorities from about sixty countries adhering to the International Institute will meet in convention at Rome," said Dr. Charron, "and there, during a couple of weeks, will make a study of the reports presented, and discuss actions which may be thought proper to take in order to cope with the difficulties which confront the agricultural world."

"The International Institute of Agriculture was organized in 1905, as a result of the activities of the late David Lubin, of

Sacramento, California. Mr. Lubin's original conception was concerned chiefly with means to overcome the lack of organization and co-operation amongst farmers and farming interests. His idea was that if the farmers of the whole world might co-operate to study agricultural problems and bring together the results of their research they would come more definitely to a better solution of their problems. The convention held in 1905, resulted in a world-wide agreement among the agricultural economists of various countries to organize an Institute of Agriculture, whose duty would be, to co-ordinate the efforts of research workers and publish agricultural statistics for the information of all concerned. In 1908, the delegates of forty governments met at Rome, and definitely organized the permanent bureau of the International Conference of Agriculture. Since that time, every second year, except during the war, delegates from all parts of the world officially representing their governments have met in convention at Rome, and there discussed agricultural problems, and devised means of action for their solution."

SOCIETY OF CHEMICAL INDUSTRY, CANADIAN PACIFIC SECTION

On March 18th, members of the Canadian Pacific Section of the Society of Chemical Industry, the British Columbia Chemists' Club and the Student's Chemistry Club, of the University of British Columbia, joined in accepting an invitation to visit the new plants of the Triangle Chemical Company, and of the Acetate Products, Limited, recently established near the mouth of the Fraser River.

The Triangle Chemical Company at New Westminster are manufacturing chamber, battery and concentrated sulphuric acid, as well as hydrochloric acid, superphosphate, and a wide range of other fertilizers. Extensions to other lines of heavy chemical products are being planned. The visiting chemists greatly admired the excellence of design and process control in the plant and particularly the safeguards to prevent broadcasting of objectionable fumes. The Company have set a high standard for their fertilizers, and other products, all of which are finding a large and growing market in Western Canada.

Mr. R. J. Walley, B.Sc., (Manchester), formerly superintendent of the James Island plant of the Canadian Explosives, Limited, is superintendent of the new Company, and associated with him are, Mr. E. Legg, formerly superintendent of the Victoria Chemical Company, and Mr. M. H. Dobie, formerly sales manager of the latter Company.

The Acetate Products Limited, at South Westminster, have recently put their first unit into operation for the destructive distillation of wood from the alder tree which grows prolifically on the Pacific coast, reaching a diameter of a foot or more. The plant is equipped with the most improved facilities and apparatus for the production or refining of charcoal, wood tar oils, acetate of lime and methanol (wood alcohol). As this is the first complete wood distillation plant to be established in western America, an unlimited local and export market is found for the products.

Mr. Norman Ross has been chiefly interested in promoting the new industry, while Mr. P. A. Carleton has supervision of the design, construction and operation of the plant. For a number of years, Mr. Carleton superintended the operation of hardwood distillation plants in Eastern North America, and since coming to British Columbia, has consulted with Dr. H. K. Benson, Professor of Industrial Chemistry, University of Washington, and Director of the Seattle Station of the United States Forest Products Laboratory. Dr. Benson has specialized on the utilization of North West Pacific Coast woods, having carried out extensive chemical researches in this field of investigation.

After the excursion, members of the British Columbia Chemists' Club attended a dinner at the Vancouver Citizen's Club, following which, a discussion was held on the subject of legislation for Professional Chemists and the advisability of forming a local section of the Canadian Institute of Chemistry.

J. A. Dawson,
Honorary Secretary

APRIL MEETING, CANADIAN PACIFIC SECTION

Following dinner at the University Club, Vancouver, B.C., a meeting of the Canadian Pacific Section of the Society of Chemical Industry was held at the Board of Trade Council Rooms, on Friday, April 7th, 1922.

Addresses were given on the subject of "Prospects for Commercial Drug Plant Cultivation in British Columbia," by the following members of the staff of the University of British Columbia, namely, Prof. R. H. Clark, M.A., Ph.D., Dept. of Chemistry; Prof. A. H. Hutchison, M.A., Ph.D., Dept. of Biology; and Prof. John Davidson, Dept. of Botany.

Dr. Clark made a preliminary verbal report on certain researches, being carried out under a grant from the Honorary Advisory Council for Scientific and Industrial Research in Canada. Following suggestions obtained by consultation with experts of some of the larger wholesale manufacturing drug companies in Eastern North America, a list of native drug plants has been selected for investigation and related economic and scientific factors are being studied.

Last year a paper was published on the "Salicin Content of British Columbian Willows and Poplars." (See. Am. J. Pharm., 93, 618, Sept., 1921). The subject of Cascara Sagrada extracts from RHAMNUS PURSHINAUS, D.C., is being investigated at present. Considerable information has been obtained on the chemical composition and the physiological effects of extracts made from various materials gathered directly from growing trees of different ages and prepared under special conditions of ageing and treatment. In this work, the co-operation of the medical staff of the Vancouver General Hospital has been of invaluable assistance. The annual world consumption of Cascara bark is estimated to be 10,000 tons, and the wholesale buying price has advanced from eight cents in 1914, to twenty-five or more cents per pound at present. Owing to the destruction of Cascara trees by Asiatics in British Columbia, who gather most of the bark, the natural supply is becoming rapidly depleted, and steps are being advocated to have Government regulations established to conserve this natural resource.

Dr. Hutchison illustrated by tables and curves, certain results obtained in the physiological standardization on cats, of digitalis extracts made under varying conditions of time and temperature, from leaves of locally-grown DIGITALIS PURPUREA, Linn.

Prof. Davidson discussed possibilities of developing a medicinal plant industry in British Columbia emphasizing the importance of economic, chemical and biological preliminary investigations. Scientific and commercial data were given on forty native medicinal plants, most of which are being successfully grown at the University Botanical Gardens at Point Grey, near Vancouver. The extremely wide range of soil and climatic conditions obtaining in British Columbia make it possible that several non-indigenous plants could be successfully introduced as has already been demonstrated in the case of certain fruits, flowers, vegetables and cereals. Prof. Davidson advocated Government assistance for Cascara reforestration, instancing the success of cinchona and rubber plantations in the British Asiatic Indies.

During the discussion of these interesting addresses, a communication was read from Mr. Cyril J. Berkeley, Biochemist at the Marine Biological Station, Nanaimo, B.C., relating to the growing of the santonin-yielding ARTEMESIA in British Columbia. Prof. Davidson stated that he had obtained ARTEMESIA seeds from Russia and France before the war, but that none of them had developed in the moist climate of the coast, whereas they would probably thrive in the interior of the province.

A suggestion was also made that poppies might be grown locally for the legitimate manufacture of medicinal opium and its alkaloids. In this connection, reference was made to the production of 1,209,600 pounds of raw opium in British India in 1920, and to exports during the same year of 1,473,080 pounds of this material. (See Jour. Soc. Chem. Ind., 41, 82R. Feb. 28, 1922). Two instances of the cultivation of poppies on a considerable scale were reported. In one case, the growers who were Germans, claimed that the poppies were being allowed to ripen for the seeds which were used in the making of puddings. In the other case, a Japanese had a field of ten acres located in a remote part of the interior, entirely planted with poppies, and surrounded on all sides with a deep border of tall sunflowers. No satisfactory explanation could be elicited from the poppy-growing Oriental as to his motives, so the crop was destroyed by Government officials. Thus the first attempt at growing "drug" plants in British Columbia was nipped in the bud.

J. A. Dawson,
Honorary Secretary

OTTAWA SECTION, SOCIETY OF CHEMICAL INDUSTRY

A well attended meeting of the Ottawa Section, Society of Chemical Industry was helt at the University Club, Thursday evening, April 6th. The chairman, F. J. Hambly presided, and after the business items had been disposed of, a symposium on "Some Modern Problems in Agricultural and Food Chemistry," was held.

The first paper was read by Dr. Frank T. Shutt, who traced the development of the Experimental Farm in Canada from its inception in 1886. The speaker dealt with the reasons for the establishment of the Experimental Farms in Canada, which he said were primarily to encourage the development of agriculture and to assist the farmer in a profitable pursuit of agriture. The farms were both educational and experimental in their work. Dr. Shutt also outlined the development of some of the work done by the Division of Chemistry, making more particular reference to the examination of soils and fertilizers, and to the development of irrigation projects. "Agricultural science," he said, "was a phase of chemistry, and that the assistance of a chemist was required in every division of the Experimental Farm. In this way, the Division of Chemistry had grown into what was now in many ways, a bureau of Chemistry, serving, not only every Branch of the Department of Agriculture, but also many other departments."

Dr. Shutt was followed by Col. Janson, of the Division of Chemistry, who spoke on the preservation of foods, with special reference to canning and dehydration. Col. Janson outlined the seven recognized ways of preserving foods, in drying, salting, pickling, smoking, refrigeration, canning and dehydration. He sketched the characteristics of each process, and traced in particular, the development of the canning and dehydration processes.

After the papers had been read, one or two other items of business were discussed. Mr. E. A. Thompson asked that the Society of Chemical Industry take action in connection with the compensation of chemists in the Government service. He said that a satisfactory plan of classification had been drawn up by the Civil Service Commission, and submitted to the Treasury Board last November, but that no subsequent action had been taken. He urged that the Ottawa Section of the Society of Chemical Industry interview the Prime Minister, on behalf of the chemists. After some discussion, in which a number of those present took part, it was agreed that the Committee of the Ottawa Section should endeavor to arrange an interview with the Prime Minister on behalf of the Government chemists. —S. J. Cook, Secretary.

American Chemical Society's Spring Meeting

American Chemists Meet at Birmingham, Alabama, April 3rd-7th.

During the week of April 3rd, Birmingham, Alabama, was the scene of the 1922 Spring Meeting of the American Chemical Society. The event proved eminently successful both in attendance and in the high standard maintained by the papers presented. Monday, April 3rd, was devoted to council meetings and on Tuesday morning the general session opened in the auditorium of the Hotel Tutwiler by an address of welcome from Nathan L. Miller, Governor of Alabama, which was responded to by Edgar F. Smith, president of the Society. The remainder of the day was given over to the presentation of addresses to the general meeting, the speakers and subjects being as follows:

Carlile P. Winslow, director, U. S. Forest Products Laboratory, "The Development of the Forest Products Industry in the South."

William H. Stone, associate editor, "Manufacturers Record," "The Remarkable Development of the South and Its Relations to the American Chemical Industry."

Theodore Swann, "The Manufacture of Phosphoric Acid in the Electric Furnace by the Condensation and Electrical Precipitation Method."

Van H. Manning, "The Pioneer's Field in Petroleum Research."

Charles L. Reese, "Information Needs in Science and Technology."

W. C. Greer, "Recent Developments of the Chemistry of Rubber."

W. D. Bigelow, "Some Research Problems in the Canning Industry."

Francis P. Venable, "Chemistry in the Old South and the New."

On Wednesday and Thursday Divisional Meetings were held, while excursions and side trips were made on Friday and Saturday. A feature of the week was the inviting of the people of Birmingham to a public meeting at which Marston Taylor Bogert, past president of the Society, gave a most interesting address on "The Flower Fields and the Organic Chemist: Perfumes Natural and Synthetic."

Abstracts of some of the more important papers presented to the meeting follow:

Physical Properties of Rubber Compounded with Light Magnesium Carbonate.

By H. W. Greider.

The physical properties of rubber compounded with light magnesium carbonate have been studied, including tensile strength, elongation, hardness, resilient energy capacity, and permanent set. This material was shown to behave in rubber as a reinforcing or toughening pigment, the maximum effect being given by nine volumes of the filler to 100 volumes of rubber. The principal disadvantage of magnesium carbonate in rubber was found to be the high permanent set imparted to the vulcanized product, attributable to the definite crystalline character of the particles. The reinforcing effect of magnesium carbonate at nine volumes per hundred of rubber was compared with equal proportions of other reinforcing pigments including zinc oxide, gas black, fine china clay and colloidal barium sulphate. Gas black was shown to be the only filler showing a reinforcing effect greater than that given by light magnesium carbonate.

The Internal Mixer as a Factory Unit.

By R. P. Dinsmore.

The study of the internal type of rubber mixer in factory production has revealed two defects. The ratio of cooling surface to volume of stock is so much less in such a mixer, than on a mill, and the working is so much more rapid that the temperature of the batch rises rapidly, and in most tire stocks it is impractical to add sulphur before the batch is taken out of the mixer.

Also these mixers require considerable batching-out equipment in order to sheet out the finished stock thin enough so that it will cool in a reasonably short time. The time for batching-out does not vary greatly and it is difficult to balance mixing equipment with batching-out equipment.

The advantages to be gained from the internal mixer are: lower mixing costs, greater freedom from the dust nuisance and lighter work for the operator.

The Relation Between Chemical and Physical State-of-Cure of Rubber Vulcanized in the Presence of Certain Organic Accelerators.

By Norman A. Shepard and Stanley Krall.

Hexamethylenetetramine, aldehyde ammonia, p-nitrosodimethylaniline and thiocarbanilide, respectively, have been introduced in such quantities into a mixing consisting of 48 parts of first latex crepe, 48 parts of zinc oxide and 3 parts of sulphur, that equivalent physical states of cure (as gauged by the stress-strain relations) were obtained in each case when vulcanized for 60 mins. at 287° F. The co-efficients of vulcanization of these cures show that there is no uniform relationship between the physical and chemical states of cure in these stocks, even though the time and temperature of curing are constant.

The equivalent quantities used in this work indicate that, in the type of stock here examined, one part of hexamethylenetetramine is equivalent in accelerating power to one and one-half parts of aldehyde ammonia, three parts of thiocarbanilide and one-half part of p-nitrosodimethylaniline, respectively.

The Thermal Properties of Various Pigments and of Rubber.

By Ira Williams.

The thermal conductivity and diffusivity of rubber is determined by two separate methods. A method for the determination of the conductivity of pigments is given and the values have been determined for the most common pigments used in rubber compounding. A method is shown by which the thermal conductivity and diffusivity of any rubber compound may be calculated from an analysis of the stock.

Hydrogen Ion Concentration and the Properties of the Emulsoid Colloids.

By Robert H. Bogue.

It is shown that the various physical properties of the emulsoid colloids, as viscosity, jelly strength, melting point, and joining strength (of glues) are at a minimum at a hydrogen ion concentration corresponding to the isoelectric condition. As the acidity or the alkalinity of the solution is increased from this point, these properties rise in value to certain maxima.

It is shown that salt precipitations for gelatin content should be made at the isoelectric condition if maximum precipitation is desired.

The necessity for a careful control of hydrogen ion concentration in investigational work on the emulsoid colloids is emphasized, and the desirability of a similar control in the plant during manufacture is pointed out. The limitation of benefit from such control makes questionable, however, the practicability of such methods for the purpose of the improvement of grade.

The estimation of hydrogen ion concentration as one of the tests in evaluation is urged, but it is not recommended that all tests for viscosity, jelly strength, etc., be made at a specified pH value.

PERSONAL

Ross E. Gilmore has resigned his position as Chief Chemist, Standard Chemical Co., Montreal, to assume the duties of superintendent, Fuel Testing Laboratories, Mines Branch, Department of Mines, Ottawa.

E. A. Smith has been appointed Chief Chemist, Standard Chemical Co., Montreal, following the resignation of R. E. Gilmore.

Dr. James M. Bell, a graduate of the University of Toronto, has been made head of the Department of Chemistry in the University of North Carolina, with which university he has been connected for a number of years as professor of physical chemistry.

W. Kynoch has been appointed superintendent of the Forest Products Laboratories, Montreal.

E. G. R. Stoneman has been appointed to the position of power engineer with the Bell Telephone Co., and will be located at Montreal. He has been connected with the Company since 1914 when he entered their service as a storage battery expert. He is a graduate of the Chemistry Department, Faculty of Applied Science, University of Toronto.

NEW MEMBERS OF CANADIAN INSTITUTE

Student

Mr. George Kay, 184 Lee Avenue, Toronto, Ont.

American Society for Testing Materials.—The 25th Annual Meeting of the American Society for Testing Materials will be held at the Chalfonte-Haddon Hall, Atlantic City, N.J., during the week of June 26th, 1922. A number of topics of live interest to materials engineers will be discussed.

NEW CHEMISTRY BUILDING FOR UNIVERSITY OF SASKATCHEWAN

The University of Saskatchewan announces that a contract has been let for the construction of a new chemistry building at Saskatoon, Sask. The cost will be $650,000. It is estimated that the building will be completed by August, 1923. Dr. T. Thorvaldson is professor of chemistry at this university.

MRS. E. B. EDDY ESTABLISHES CHAIR OF INDUSTRIAL CHEMISTRY AT McGILL

The name of Eddy is linked in the minds of this generation with wood product industries. Now McGill is favored with a bequest, sufficient to establish a professorship in Industrial Chemistry; and it is being pointed out that the forest products industries should receive attention at the hands of the University. Already McGill is well equipped to undertake this work, and there is enough chemistry about these industries to satisfy anyone. Pulp and paper men may well and rightfully anticipate that the new work made possible will relate to problems, fundamental to progress in dealing with our forest resources.

CANADIAN INSTITUTE MEMBERSHIP

The membership of the Canadian Institute of Chemistry as of date, April 21st, 1922, totals 256, including two Honorary Fellows, 167 Fellows, 37 associates and 50 students.

The Business Outlook

FOR the benefit of Canadian chemists who are rather anxiously searching the horizon for signs of better industrial conditions, we asked a few of the companies who might be in a position to judge the extent of trade recovery from the chemical and allied chemical viewpoint, to give us an expression of opinion.

On the whole, the feeling expressed is very encouraging. Our metallurgical industries of all kinds should have a very fair year, and many special industries are much more hopeful than they were. The letters we quote below, are from widely different types of industries, and we present them to our readers in this Convention Number, as some indication of business at the moment in Canada.

W. H. Galt, Gutta Percha & Rubber Co., Ltd.

"In response to your favor of the 15th inst , our impression is, generally speaking, that conditions in our particular line of manufacture are steadily showing signs of improvement. We do not anticipate any tremendous boom, but rather a steady, gradual improvement in conditions as the situation improves, generally throughout this country. From this, you will gather, that we feel the depression has about run its course, and that we can look for a gradual betterment of conditions in our line of business."

C. Elder, Canadian Hanson & Van Winkle Co., Ltd.

"As requested in your letter of the 13th inst., we are pleased to give you our opinion of the present business situation, as affecting our business.

During the past three months, we have noticed a more confident attitude on the part of buyers of electroplating chemicals. No one is buying in excess of immediate need, but their demand is constantly increasing, and due to the market stiffening on some commodities, we have advised booking ahead, for at least three months.

In electro-cleaning, and chemicals for still solution, we have found a decided increase in business for this year, especially among the automobile manufacturers, and makers of accessories.

In our estimation, the existing condition and outlook for the future is decidedly favorable, and we confidently expect at least 25% more business during 1922, than last year."

A. Nieghorn, The Nichols Chemical Co., Ltd.

"Acknowledging receipt of yours of the 13th inst., in the matter of the business outlook as it appears to me.

"The buying tendency in chemicals, with the exception of those used by the Steel Trades, is rapidly approaching a normal condition, and the real bad times have undoubtedly been passed.

"While it is an easy matter to raise wages and freight rates, it is exceedingly difficult to get them down again, yet both wages and freight rates must be reduced considerably, before any expansion in trade may be reasonably looked for in Canada."

E. Peterson, Imperial Trading Co.

"We are glad to state that the chemical section of our business is improving from month to month. This we believe, is due, mostly to the fact that stocks are generally low, both in manufactured products that use chemicals, and raw materials, as well, and now that prices are relatively stabilized, we are looking for a gradually increasing volume of business."

L. T. Acton, "Shoe & Leather Journal"

"So far as the business outlook is concerned, it is still a very dangerous thing to hazard a prophecy. The shoe and leather industries with which we are in close touch, are still in a relatively quiet state. The general feeling of the trade, however, is that the worst is over, that drastic price reductions are at an end, and that so far as raw materials, such as hides and leather are concerned, increased demand is likely to cause a decided stiffening which can hardly be offset by labor reductions or reduced cost, due to increased output. The weak spots of the situation have been pretty well uncovered, and while the next few months may still send some weak concerns to the wall, given any kind of favorable crop results, next fall should show decided improvement in business. Of course, permanent prosperity cannot be reached until the export situation is materially improved by more settled world conditions."

H. W. Matheson, Canadian Electro Products Co., Ltd.

"I have very little to say regarding the business outlook. This, however, in general, I would say is improving very materially from our standpoint, more especially with reference to the English business. The demand in the United States is also increasing steadily, but the new Tariff Bill, if passed in the form in which it was sent to the Senate, will be a serious blow to any export business with the United States; in fact, from our standpoint the Bill is practically exclusive."

G. F. Allen, Hoyt Metal Co.

"After a careful diagnosis of the business situation of the country, from all districts, we have come to the conclusion that the liquidation of prices has now been completed and the tendency of the market is slightly upward. We cannot help but feel, from a careful analysis, that this year will show gradually increasing prosperity, and that trade will come back very rapidly to normal. The re-adjustment period has been passed safely, and for a number of years to come, we can see nothing but gradually increasing trade. We do not look for anything phenomenal, but a steady advance in trade conditions."

E. M. Grose, Ontario Fertilizers, Limited

"Before venturing an opinion as to the future outlook of the fertilizer business, it would be well to take a retrospect of the fertilizer situation covering the early part of the spring fertilizer shipping season, say from December 1st, 1921, to March 1st, 1922.

During this time there was a strong disposition on the part of the consumer to withhold purchasing fertilizer, partly due to the fact that lower prices were looked for, and secondly to the stringent financial position in which the farmer found himself owing to unfavorable crop yields in 1921, and to a marked deflation in the price of farm products.

As a natural consequence, fertilizer manufacturers did not accumulate heavy stocks of materials. Mineral ammoniates, generally speaking, remained stationary, while organic ammoniates showed an upward tendency. The advance in the price of organic ammoniates continued until about the first of April. Since that time the market has eased off considerably. The price of mineral ammoniates has risen since the stationary period above mentioned, and there is now a slightly weaker outlook for mineral ammoniates such as Nitrate of Soda and Sulphate of Ammonia.

Acid Phosphate quotations to manufacturers have remained practically stationary throughout the spring shipping season. Potash has shown a slightly lower tendency during the past few weeks.

During the past two months, manufacturers of fertilizers have experienced a busy shipping season, which no doubt, will continue until the middle of May.

One of the striking features of the fertilizer sales this year, is the fact that the average analysis of the fertilizer shipped is much higher than in previous seasons. This may be accounted for, by the fact that the prices of fertilizers are considerably lower than for some years, and also to the fact that the ultimate consumer is being thoroughly convinced that high-grade fertilizers are much more profitable than those brands of low analysis.

The outlook for the Fall wheat trade is good, for the reason that the fertilized wheat has come through the winter remarkably well, and is showing up to good advantage. Also the future grain sales indicate that wheat will be a profitable crop this year.

W. J. Michaud, Winn & Holland, Ltd.

"Replying to your request for our impressions of business conditions, the greater part of our business is direct with Canadian industries of varied description, so that we have generally found our fluctuations a good barometer of general industrial conditions.

"We have noticed a perceptible improvement, both in actual orders, and sentiment, and it is our belief that this progress will continue, possibly slowly, but steadily."

F. A. Bapty, Deloro Smelting & Refining Co., Ltd.

"We would advise that our business is chiefly an export one, and naturally has been badly upset by world-wide conditions. We are pleased to say, however, that recently, we have had intimations of a revival in trade in our particular lines in different parts of the world. We can therefore report a very decided improvement over conditions which existed a year ago. We believe that a sure, steady growth in trade, is much more desirable than any sudden boom, and from the indications received, we have quite an optimistic feeling towards the future. It is our intention shortly, to resume operations in a portion of our plant which has been closed down for some time past, which is a practical intimation that we feel the worst is over, and that we are again on the road to better things."

World Conditions and News in Chemical Fields.

(Special Correspondence to Canadian Chemistry and Metallurgy by Our London Representative)

Amongst the developments in the chemical industry which are of interest is the formation of the British Chemical Plant Manufacturers' Association, which by co-operation with the Association of British Chemical Manufacturers brings together the makers and users of chemical plant. Previous to the war there was a tendency for the chemical manufacturers to go to the Continent and to America for their plant, but it is believed that in future there will be no need for this, and that all the chemical plant required will be obtainable from British sources. Included in the useful work which these two associations are jointly undertaking is the standardization of chemical plant, and a report on jacketed cast iron and enamelled pans has recently been issued. In this connection the two associations are also co-operating with the British Engineering Standards Association, and in this way overlapping of activities will be avoided.

The British Industries Fair

Exhibitors at the British Industries Fair were fairly well satisfied with the amount of business done. Numerous inquiries were made, and quite a number of satisfactory orders booked. Visitors from overseas, however, were not so numerous as had been expected. Quite apart from orders, however, the Fair has been particularly useful from an educational point of view, and visitors have been impressed and possibly surprised by the growth and development of the British chemical industries. Hopes are expressed that the already unmistakable signs of a revival in trade will be considerably strengthened by the success of this exhibition. The large chemical section organized by the Association of British Chemical Manufacturers was very comprehensive and representative, and especially in the case of dyes and fine chemicals was it hoped to convince foreign buyers that British manufacturers are willing and able to meet their requirements with satisfactory products at competitive prices. More than fifty members of the Association exhibited, and it was clear that more progress has been made in the production of dyes and fine chemicals than in other branches of the industry. A notable exhibit in this section was that of Scottish Dyes, Limited. This company has concentrated on the production of synthetic dyestuffs and intermediates. A group of acid alizarine dyes have been produced for use in high-class cloths in which permanence of the color is particularly desired. The company's Caledon colors for cotton have also won a considerable reputation. These are vat colours, and with them effects can be obtained which will withstand acids, repeated washings, and prolonged exposure to sunlight. Another company making a special feature of alizarine colors is Grays Dyes and Colours, Limited, who claim to be the second largest alizarine manufacturers in England.

The British Dyestuffs Corporation stand was a convincing demonstration of the advance made by this branch of the chemical industry. The exhibit is designed to show the application of the dyes to fifty different sections of industry—mainly textile—in which the products of the company are used. An imposing array of the dyes is made in bottles and impresses on the visitor the growing strength of the British dyes industry. An imposing exhibit was that of the United Alkali Company, who are manufacturers of chemicals of all kinds, and a demonstration of what is being done by gas companies in the production of coal tar and ammonia products, including benzol, toluol, and sulphate of ammonia, inorganic products, including oxide of iron and sodium sulphide, as well as intermediate for dyes and heavy organic acids, was given by the exhibit of the South Metropolitan Company. The feature of the stand was a lighthouse built of metropitch, which stands in a sea of sulphate, the dry quality of which is demonstrated by the ease with which it flows through a large hour-glass.

The heavy chemical section was well represented. Photographic chemicals are also shown in this group, as well as soaps, among the last-named branch of the chemical industry being the well-known firms of Joseph Watson and Sons, Limited, and John Knight, Ltd., whose special shaving soap is so largely used. Drugs and druggists' sundries and pharmaceutical chemicals are shown by some of the firms exhibiting in the chemical section proper, as well as by such well-known houses as Burroughs, Wellcome and Co., Boots Pure Drug Company. Mention may also be made of the exhibit of Stafford Allen and Sons, who prepare essential and expressed oils, flavoring essences, synthetic perfumes, medical herbs and roots, and powdered drugs and spices.

Photographic Chemicals Being Developed

The photographic branch of fine chemical manufacture has been greatly developed in the United Kingdom. Research has been actively pursued, and at the present moment the list of developers available is remarkably complete, embracing all those in universal request such as hydroquinone, amidol, and metol. Glycein has been added to the list, while the British equivalent for rodinal, namely "azol," has been on the market for a considerable time. The manufacture of these German proprietaries on a big scale in such a comparatively short period is a triumph for British enterprise.

Synthetic Nitrogenous Fertilizers

Synthetic nitrogenous fertilizers continue to attract much attention. An English company is now working a semi-large scale plant, producing one ton of ammonia a day, and the output is soon to be increased to two tons. Another company proposes to erect a works in Cumberland with an initial output of 50,000 tons of sulphate of ammonia per annum, using the Claude process. The standard ammoniacal fertilizer is sulphate of ammonia. The usual grade as made by good firms is guaranteed to contain twenty-five and one-quarter per cent. of ammonia, but a little free acid is present which interferes with the removal of the last fraction of moisture. A "neutral" form is now being produced which can be better dried, and, therefore, assumes a more friable condition—a great advantage from the farmer's point of view as it facilitates spreading. The presence of acid also rots the bags. The removal of water raises the ammonia content, and a guarantee of twenty-five and one-half per cent. is given.

Cellulose Ethers

The development of gas warfare has resulted in an immense advance of knowledge in the preparation of activated and decolorizing carbon. The conditions governing and promoting activation have now been firmly established, and products of first-class quality are now available in this country.

The preparation of cellulose ethers is one of the most interesting developments in cellulose chemistry during recent years. These bodies, formed by suitable treatment of specially prepared alkali cellulose with alkyl halides or dialkyl sulphates, form suitable bases for the production of plastic masses having high insulating power, great stability, and water resistant properties. Such bodies are now used for the production of non-inflammable celluloid, films, varnishes, artificial glass, etc. An endless variety of fancy goods can be produced in all colors and patterns such as tortoiseshell and marble.

Somewhat similar products are, however, now being made from quite a different material, namely, casein, from skimmed milk. The name galalith has been applied by the Germans to these products, and they are now being made by some half-dozen British firms. Synthetic resins and synthetic tanning materials ("syntans") are also now produced in this country. These substances are condensation products of aromatic substances with or without the addition of formaldehyde. The use of varnishes made from synthetic resins is increasing particularly in those cases where high electrical or chemical resistance is required.

British Non-Ferrous Metals Research Association

From the second annual report of the British Non-Ferrous Metals Research Association, of 71 Temple-row, Birmingham, it is evident that considerable progress has been made during the second year of the Association's existence and that it has a Council and officers possessing the confidence of the industry. The number of member firms now supporting this Association is over one hundred, and through several active committees, the Council has initiated a great deal of valuable work. Members apply to the information bureau for assistance when requiring technical or other information. Many investigations which will benefit both manufacturers and users of non-ferrous metals are in progress in all the great metallurgical laboratories in the country, including the National Physical Laboratory and the Universities of Sheffield, Birmingham and Manchester. The Association is assisted by all the prominent metallurgical professors in the country, and its progress is a reassuring indication of the value of the movement towards research associations which, it is to be hoped, will become a prominent feature of British industries.

The British Glass Industry

During the past year, manufacturers, by cutting wages, economizing in works management, and giving the public the benefit of any fall in the cost of raw materials, have been able to reduce prices in some instances as much as fifty per cent., yet trade still continues poor, not more than forty per cent. of the operatives being fully employed. The industry has now an output capacity equal not only to the requirements of the home market, but sufficient to meet the needs of overseas customers, a branch which it is earnestly desired to cultivate. If confidence can be retained there is no doubt that, as soon as trade conditions approach the normal, the British manufacturer will be able to show goods comparable with those of any country in the world at competitive prices. In this country is produced the finest glass in the world, and English crystal cut still defies emulation. Those who desire to establish this fact have only to see some of the magnificent work done for Indian princes on the occasion of the Prince of Wales's visit or, to take more recent example still, view the beautiful glass presents made for Princess Mary. In these, the heights of the glass-makers' art have been reached.

Mining and Metallurgy in British Columbia.

(Special Correspondence to Canadian Chemistry and Metallurgy.)

Quite the outstanding feature of the month has been the declaration by the Premier Gold Mining Company of a dividend of $500,000 for the quarter ended March 31st, on its capital of $5,000,000. It only recently has become known that this company distributed a dividend of $400,000 on December 31st, 1921; the disbursement having been kept quiet. It is understood because the company desired to obtained additional ground adjoining its holdings in the Salmon River district. The achievement of the company is the more remarkable when it is remembered that the tramway was put into operation only at the very close of last year, and that previous to the completion of the tramway ore was moved from the mine to the head of the Portland Canal under great difficulties and at high cost. The hydro-electric plant has to be completed, a plant for the treatment of precipitate from the cyanide plant erected, additions have to be made to the compressor plant, and it is possible that another unit may be added to the concentrating cyanide plant. It is said that sufficient ore has been developed to enable the company to maintain the present rate of output for the next ten or fifteen years, and that as yet the limits of the orebody have not been reached in any direction. During the first three months of the present year, more than 16,000 tons of ore have been shipped from the mine. The high-grade, which runs anywhere from $75 to $300 per ton, is shipped to the smelter at Tacoma; the medium-grade, running about $40 per ton, is shipped to Anyox; while ore below this grade is concentrated at the mine, and the tailing from the concentrator is ground to 200 mesh and cyanided. Without doubt, this is the most important lode mine that has been discovered in British Columbia, and probably is the most important mineral discovery in Canada since the finding of the Hollinger in 1910.

Boom in Placer Mining

A lode-mine, however, never has the same attraction to the hoi polloi that a placer mine has; the latter as a rule needing far less capital for its development. Just now Cedar Creek is on everyone's lips. Not to own at least a share in a lease on Cedar Creek is a sign of abject poverty in this part of the world. As previously reported, the discovery was made by two prospectors, Platt and Lyne, on a bench 500 feet above the level of Cedar Creek. They have been working their claim steadily during the winter, and, it is stated, have cleaned up on an average of $250 daily, and this without over-exertion. The claim is bonded for $250,000, and the first payment has to be made by the middle of this month, or the option lapses. The success of these two men has sent the country wild, and practically the whole of the country for a considerable distance to the east of Quesnel Lake has been staked, much of the staking having been done in the snow. These leases are changing hands at anything from $500 up, quite regardless of the direction of the pay-streak, which as yet has not been determined. Engineers attached to the Provincial Department of Mines estimate that there will be at least 5,000 prospectors in the district during the coming summer, and probably double that number. There will be many disappointments, of course, but, at the same time, there are likely to be a good many discoveries, for it is generally accepted by mining engineers and geologists that are familiar with the district that much gold still remains unmined in the Cariboo district. The Cariboo gold placers are pre-glacial, geologists claim, and during the glacial period became buried under a heavy burden of glacial clay and gravel, hence, it is believed; many deposits are yet to be discovered. Cedar Creek would seem to be an instance, for it was one of the creek in which gold was first discovered, in 1862, and is said to have been well prospected.

Cedar Creek will by no means be the only place in the Cariboo district to attract the miner this year. Already two or three companies have made plans for operating dredges, which previously have not been used in the district. A good deal of profitable ground has been demonstrated in the vicinity of Barkerville by Keystone drills, and other ground will be drilled as soon as weather conditions permit. In some parts, drills are now in operation.

A new discovery of considerable interest was made in the Whitewater district, which lies at a high altitude about midway between Cariboo and the coast. While up to the present, gold has been obtained only by washing and rough grinding in the crudest of appliances, it is really a lode-gold find, and it has been bonded by Joseph Tretheway.

The Coal Strike

The coal miners' strike does not seem likely to affect any but the Crow's Nest mines in British Columbia, and it is not expected to inconvenience the cities and towns on the coast. The Vancouver Island mines and the Nicola-Princeton field are not affiliated to the United Mine Workers' Union, and the mines in these districts are still operating, as are those in northern Alberta. These mines, together with the fuel oil that comes from California, are well able to take care of the needs of the British Columbia coast towns and cities. If the strike is prolonged, the Trail smelter, which gets its coke from the Crow's Nest mines, will be affected, but, it is rumored, the Consolidated M. & S. Co., is contemplating the erection of by-product ovens, which would render it independent, as it then could obtain coal from either Vancouver Island or Nicola-Princeton mines.

BRITISH COLUMBIA INDUSTRIAL NOTES

J. H. Johnston, Mayor of Prince George, is responsible for the announcement that the Bathurst Company, Ltd., has been organized with a capital of $3,000,000 to take over a tract of timber land east of Prince George and to erect a paper and pulp mill, capable of turning out 150 tons of pulp daily. According to Mr. Johnston, the organizers include Lord Beaverbrook, Angus and H. K. McLaren, Sir Charles Gordon, Frank Jones, of the Canada Cement Company, and Peck Brothers, of Pennsylvania. The tract of timber land is 200 square miles in extent, and has been pronounced by experts who have examined it to contain wood well suited for the manufacture of pulp. Negotiations between officers of the company and the Provincial Minister of Lands have been under way for some time, and some weeks ago the Minister stated that satisfactory arrangements had been made and he had little doubt but that the plant would be built. It is stated that work on the construction of the plant will be commenced in June.

The Western Canada Pulp & Paper Company, Ltd., is to be re-organized. The company owns a large plant at Port Mellon, on Howe Sound, which has been idle for several months.

The east wing of the Vancouver Rolling Mills was destroyed by fire on the evening of March 31st. The loss is placed at between $50,000 and $60,000. Preparations already are under way for the re-building of the plant.

DEMAND FOR PAPER INCREASING

The Canadian Pulp and Paper Association reports that the demand for Canadian paper by American publishers shows a steady return to normal. Most of the mills in this country are now working to about ninety per cent. of their capacity. There is an impression that stability in prices has been reached, and that the increased production made possible by the mill's expansion during the last three years, is in a fair way soon to be overtaken.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST

Reported to Canadian Chemistry and Metallurgy by A. E. MacRae, Ottawa

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Purification of Zinc Bearing Solutions

R. T. D. Williams, R. T. Gepp and K. P. Webb, 215,901, Feb. 21, 1922. Mn. is removed from Zn. bearing solutions to be used in the manufacture of lithopone by the addition of bleaching powder and Na_2SO_4. The hypochlorite does not interfere with the proportions of $ZnSO_4$ and BaS in solution necessary for the reaction.

Process of Obtaining Manganese Peroxide.

E. H. Westling, 216,019, Feb. 21, 1922. MnO_2 is prepared from its ores by converting the peroxide into sulfate, converting the sulfate into nitrate and heating the latter to form the peroxide. Hot SO_2 is introduced into a mixture of pulverized Mn ore and water, or a mixture of $MnSO_4$ and MnS_2O_6 solution. $Ca(NO_3)_2$ is added to the solution and the $Mn(NO_3)_2$ formed is heated to form MnO_2.

Chloridizing Ores.

J. H. Hirt, 216,026, Feb. 21, 1922. Ores are chloridized by progressively feeding the charge through a preheating zone, a reaction zone and a cooling zone, introducing into the material in the reacting zone a chloridizing agent in vapor form and maintaining the temperature in the preheating and cooling zone such as to prevent escape of volatile chlorides there through.

Chloridizing Ores.

J. H. Hirt, 216,028, Feb. 21, 1922. A confined body of ore mixed with a suitable chloride is subjected to the direct heating action of products of combustion free from any appreciable excess of O. The volatilized chlorides are collected in the overlying layers of the material.

Chloridizing of Ores.

J. H. Hirt, 216,027, Feb. 21, 1922. A compact body of ore mixed with chloride is heated in such a way as to prevent atms. oxidation and the escape of the volatile metal chlorides. The heating chamber may be such that there is a preheating zone, a reaction zone and a cooling zone from which latter the metal chlorides are discharged.

Production of Aluminum Chloride.

E. C. Baum and O. DeWitt, 216,030, Feb. 21, 1922. Al nitride is subjected to the action of Cl gas at 600-900°. Briquets containing Al nitride a small portion of C and Al_2O_3 may be so treated when both the nitride and oxide will be converted into the chloride.

Process of Recovering Potassium and Alumina from Feldspar.

C. M. Brown, 215,766, Feb. 14, 1922. Feldspar is heated in a rotary kiln at less than 1000° F. in the presence of SO_2 and air to produce K_2SO_4 and $Al_2(SO_4)_3$. The product is leached and the salts recovered.

Manufacture of Refractory Brick.

J. A. Wright, 215,847, Feb. 14, 1922. Refractory bricks are made from natural deposits of chromite and serpentine rock by crushing then agitating with slight moisture to evenly distribute the serpentine particles throughout the chromite and then burning in a kiln.

Fuel.

F. F. Fournier 216,151 Feb. 28, 1922. Crushed lignite is dried and partially carbonized at 120-125°, then while still hot, mixed with H_2SO_4 and pitch and molded under pressure.

Liquid Fuel.

A. A. Backhaus, 216,281, Feb. 28, 1922. A fuel contains gasolene, kero sene, Et OH and $CHCl_3$

Liquid Fuel.

A. A. Backhaus, 216,282, Feb. 28, 1922. A fuel contains a petroleum distillate, an alc and a phenol adapted to blend the other constituents.

Liquid Fuel.

A. A. Backhaus, 216,283, Feb. 28, 1922. A fuel contains gasolene, kerosene, an alc. and nitrobenzol adapted to blend the other constituents.

Liquid Fuel.

A. A. Backhaus, 216,284, Feb. 28, 1922. A fuel contains gasolene, kerosene, and alc., benzol and cresol adapted to blend the other constituents.

Liquid Fuel.

A. A. Backhqus, 216,285, Feb. 28, 1922 A fuel contains gasolene, kerosene, EtOH and linolic acid.

Liquid Fuel.

A. A. Backhaus, 216,286, Feb. 28, 1922. A fuel contains gasolene, EtOH and linolic acid.

Liquid Fuel.

A. A. Backhaus, 216,286, Feb. 28, 1922. A fuel contains gasolene, EtOH and castor oil.

Aeroplane Motor Fuel.

W. T. Schreiber, 216,287, Feb. 28, 1922. A honogeneously blended fuel contains 40-60 parts of EtOH, 30-50 gasolene, 25 benzol and 5 Ethyl ether.

Apparatus for Making Iron Oxides.

T. French, 216,153, Feb. 28, 1922.

Method of Manufacturing Al. Chloride.

F. C. Frary, 216,244, Feb. 28, 1922. Al_2O_3 is reduced in the presence of Cl and Al, the latter combining with a portion of the Cl, thus maintaining the temp. necessary for the reduction. Bauxite, Al dross and C are the preferred materials.

Catalytic Materials Adapted for Use in the Synthesis of Ammonia.

G. Claude, 216,250, Feb. 28, 1922. A catalyst for use in the synthetic production of NH_3 is prepared by directing a jet of O on to molten monoxide of Fe to which lime has been added.

Extraction and Recovery of Cu.

N. V. Hybinette, 216,249, Feb. 28, 1922. Sulphide ores of Cu ore subjected to at least two successive roasting and leaching operations and the Cu is extracted from solution by electrolysis. The ore is treated before the second roast with a solution of salts such as Na_2SO_4. to promote subsequent roasting and leaching and the Fe content is kept sufficiently low to permit the electrolysis to be carried out without diaphragms.

Aeroplane Motor Fuel.

W. T. Schreiber, 216,288, Feb. 28, 1922. A fuel contains EtOH. 35-50%, benzol, 25-35% and sulphuric ether, 20-40%.

Liquid Fuel.

A. A. Backhaus, 216,289, Feb 28, 1922. A fuel contains equal quantities of gasolene and Alc. blended by CS_2 in the fuel.

Non-Freezing Fuel.

W. T. Schreider, 216,290, Feb. 28, 1922. A mixture of alc., gasolene benzol, ether and toluol has a G. p. below 50° F.

Research students at Cambridge number 143, of which twenty-five are from Canada and the United States.

SOMETHING NEW IN PUMPS

The handling of certain materials of a semi-solid nature, or containing various kinds of possible obstructions to pumps, has been the source of much trouble and expense to manufacturers.

Pump manufacturers have in various ways, tried to eliminate these troubles, and a new type of pump has been put out, designed to deal with every possible contingency. Whatever is capable of passing through the suction, will be swallowed and discharged.

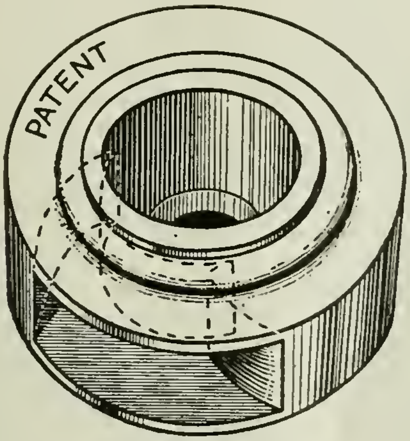
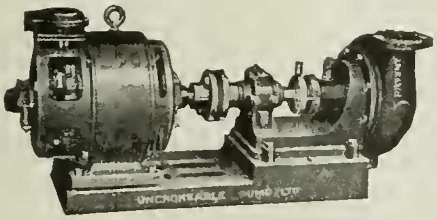


Fig 1. Patent Form of Impeller Specially Designed for Dealing with Long, Stringy Substances.

This unchokeable pump is constructed on the centrifugal principle, but so designed that fibrous solids, skins, sacking, etc. will pass through it without difficulty. It is designed to withstand hard grinding, which goes with the passage of sludge, fibres and solid matter. The internal detail is novel. It is stated by the manufacturers that no screens are necessary, and that the pump can pass unscreened sewage, rags and textile effluent.



Pump with Motor Attached.

The pumps are motor or belt-driven, with flexible couplings and the bearings ring oiled. The difficulties of replacing parts and the impeller are very slight. The pump it is claimed, has handled coal, gravel, ore, sand, leaves and chemical solutions, both acid and alkaline.

This is an English product, and we are indebted to Messrs. Jones & Glassco, Manufacturers' Agents, 1311 Bank of Hamilton Building, Toronto, for these illustrations.

NEW MINING PLANT FOR FREEPORT SULPHUR CO.

The Freeport Sulphur Company, New York and Freeport, Texas, awarded contract on March 24th to Dwight P. Robinson & Company, New York and Montreal, for the design and construction of a complete sulphur mining plant at Hoskins Mound, Texas. The Company now operates a large sulphur mining plant at Freeport, Texas, consisting of four units which were built by Westinghouse, Church, Kerr & Co. (which has been merged into Dwight P. Robinson & Company) in the period from 1913 to 1918. This plant contains one of the largest installations of oil-burning boilers in the world.

MINERAL PRODUCTION, QUEBEC, 1921

A preliminary report of the mineral production in the province of Quebec, 1921, gives a total value of $15,355,861, as compared with $28,392,939 in 1920, a decrease of $13,037,078, or 45.9%. This is the lowest recorded since 1915, when it was $11,465,873. As regards the outlook for 1922, the report states:

"While it is to be hoped that 1922 will see some resumption of activity in the Quebec mining industry, the fact cannot be ignored, that the tariff legislation of the United States, which is now being discussed, and considered by both Congress and Senate, hangs like a sword of Damocles over our mine operators. The Bill provides for rates of duty on some products, which, in many cases will be prohibitive, such as mica, four to ten cents per lb. and seventeen per cent. ad valorem; magnesite, calcined, seventy-five cents per hundred pounds; magnesite, crude, fifty cents per hundred lbs.; zinc ores, (twenty-five per cent. metal, and over), $30, a ton; molybdenite, seventy-five cents per lb. of metal content."

Asbestos.—From a production of 179,891 tons of asbestos fibre, valued at $14,749,048, in 1920, production in 1921, fell to 87,474 tons, valued at $5,199,789, a decrease of 51.3% in tonnage, and 64.7% in value.

Feldspar.—Feldspar was the only mineral showing an increase in production during 1921. This is due to the fact that some large deposits of very high-grade feldspar, discovered in 1920 and 1921 near Buckingham, began shipping regularly during the year. The feldspar deposits of the region embracing the basins of the Lievre and the Gatineau Rivers, promise to give rise to a very flourishing industry. Production in 1921, is given as 9,723 tons, valued at $78,568.

Chromite and Graphite.—Chromite mining was one of Quebec's principal mining industries during the war, but 1921 naturally witnessed a great reaction, and at the end of the year, all the chromite mines were closed down, and there are very poor prospects of even one of them being reopened for some time. The shipments of cromium, in 1921, amounted to only 1,893 tons, valued at $36,913, as compared with 10,585 tons, valued at $247,730, in 1920. Production of graphite in 1921, amounted to 84,684 lbs., valued at $2,422, as compared with $31,913, in 1920.

Other Minerals.—Only 1,986 tons of copper and sulphur ores, valued at $10,463, were mined in 1921, as compared with 15,186 tons, valued at $98,854, in 1920. Production of mica, amounted to 483,197 lbs., valued at $41,092, a decrease of 85% as compared with 1920, when the value totalled $281,729, and is the smallest production of mica since 1902, when it was $34,304.

INDUSTRIAL ITEMS

Bathurst, N.B.—It is reported that Bathurst is soon to have a paper mill added to its other industries. Plans for the new plant have been completed, and work is expected to commence about June 1st next, and by early in 1923 it is believed that the Bathurst Co. will be turning out a supply of newsprint paper. The addition of the plant will provide employment for 500 people.

Winnipeg, Man.—Should support be obtained for the project from growers, located in adjacent municipalities, a vegetable canning factory will be erected and operated in Winnipeg, this year, according to one of the promoters of the enterprise. It is estimated the cannery would be able to handle the first year the crop from 400 acres of peas, 100 acres of corn, and a large acreage of wax beans, cauliflower and cabbage.

Victoria, B.C.—An organization to build up the Victoria and surrounding district jam trade, is now being organized. The Beach-Eakins Co., with a capital of $50,000, will manufacture the highest grades of jams and fruit pulp. There is, it is claimed, a large market in Great Britain for the latter product. The new plant will be in full operation by the beginning of the fruit season.

Three Rivers, Que.—The new mill of the International Paper Co. here, has commenced to produce paper. The mill has been making sulphite pulp, and started grinding wood last week. The first of its four paper machines, each weighing 700 tons, has been installed, and with the erection of the others, the completed mill will have a rated capacity of 96 tons each 24-hour day, for each machine, or 384 tons for the four machines. International Paper Co.'s total possible production will be over 2,000 tons a day, with this new capacity.

Shawinigan Falls, Que.—The Belgian Industrial Co. here is preparing to extend its paper mill, the cost of which will be from $1,500,000 to $2,000,000. This does not include the cost of machinery. Preparations are now being made for excavation work, and it is expected that the plant will be completed some time during the middle of next year.

Hamilton, Ont.—Contracts for the erection of ten bridges for the new James Bay extension of the Temiskaming and Northern Ontario Railway are reported to have been secured by the Hamilton Bridge Works Co. The bridges will cost $175,000, and when work is started on them, the company's east end plant here, will be re-opened, and one hundred men put to work.

Saskatoon, Sask.—The Saskatchewan Government, which has a very complete ceramic laboratory at the University of Saskatchewan, has now established a course in ceramics to train students. A survey is being made of clay resources of the province for information and advisory purposes, those deposits near transportation being dealt with first.

Fort William, Ont.—The Great Lakes Pulp & Paper Co. will, it is stated, erect a large paper mill here. The capacity will be 100 tons a day, and the plant must give employment to 600 men by February 1, 1925. An agreement to this effect has been made with the Ontario Government.

Toronto, Ont.—Beardmore and Company, of Toronto, plan to erect a new warehouse in connection with their tannery, at Acton, Ont., at a cost, estimated at $100,000.

Port Arthur, Ont.—The contracts for the enlargement of the plant of the Provincial Paper Mills, Ltd., at Port Arthur, Ont., have been awarded as follows: Structural Steel—Dominion Bridge Co., Montreal; Machinery Port Arthur Shipbuilding Co., Port Arthur; Building—J. C. Trimble, Toronto. The extension is to be completed by May 1, 1923, at an estimated cost of $1,500,000, and work has already commenced on the construction of the new building. The mill will be equipped with 146 book machines, with a capacity of thirty tons of paper per day, the chief market for which will be in Western Canada

Hamilton, Ont.—A modern biscuit factory will be erected. at Hamilton, Ont., by the Kanada Biscuit Co., a new concern capitalized at $1,000,000, and represented by Hamilton and Toronto interests.

COMPANY NEWS

Deloro Smelting and Refining Co.—The branch office of the Deloro Smelting and Refining Company, Ltd., of Deloro, Ontario, which has been in Toronto since the inception of the enterprise in charge of Mr. Thomas Southworth, Managing-Director of the company, has been removed to Ottawa, and is now located in the Bank of Nova Scotia Building, 114 Wellington Street. Hon. M. J. O'Brien is president, and Mr. J. A. O'Brien, vice-president of the Deloro Company, and the removal of the Managing-Director and branch office from Toronto to Ottawa consolidates control with the head office of M. J. O'Brien, Limited.

Jones & Glassco, of Montreal and Toronto, have taken on several new agencies recently. They now represent Messrs. Guthrie & Co., of Accrington, England, manufacturers of acid-proof pumps and cerathrim-lined vats, etc., and the Unchokeable Pump, Limited, of London, England. This is a centrifugal pump, designed to pass fibrous solids, skins, sacking, etc. The general principle is that of the centrifugal pump; but certain internal details make it distinctive. No screens are necessary. The firm also represents the Morse Chain Company in Canada.

The Electric Furnace Company has moved its general and sales offices from Alliance, Ohio, to Salem, Ohio. By this action, all departments of the Company will be consolidated at its works, Wilson Street and Pennsylvania Railroad, Salem, Ohio.

Dominion Tar and Chemical Co., Ltd.—Particulars relating to the company have been published for public information in England. The share capital is £300,000 in ordinary shares of £1 each, of which 200,000 shares have been issued and are fully paid, and 50,000 shares were recently issued at par, of which 2s. 6d. per share has been paid. The company was incorporated in 1903 to carry into effect an agreement with the Dominion Iron and Steel Co. to carry on the business of tar distillers and chemical manufacturers in Canada.

American Cyanamid Company—Operations of the American Cyanamid Co. throughout February, were at reduced capacities, at all plants, according to reports recently made public. There was no production of ammophos at the New Jersey plant, operations there still being confined to the limited production of certain secondary products. At the Niagara Falls plant, the production of crude cyanamid was on the basis of approximately thirty per cent. of capacity. At the phosphate mines, Brewster, Florida, mining operations were on the basis of approximately fifty per cent. of capacity. The net value of the shipments of the various products totalled $346,994.63. Sales of the various products represent a value of approximately $216,000. The company had in hand as of 28th February, contracts for various products for delivery prior to 30th June, 1922, of a sales value of approximately $1,730,000, and in addition for delivery, prior to 31st December, 1922, of a sales value of approximately $1,356,000.

THE ELECTROPLAX CO., LTD.

This is the name of the new company, organized at Toronto, to manufacture phenol condensation products, and the cold moulded products of the Cutler-Hammer Co., of Milwaukee. Dr. L. V. Redman, of the Redmanol Chemical Products, Chicago, is mainly responsible for the new Canadian arrangements for the production of these materials.

The officers of the new company are: President and General Manager, H. E. Corey; Vice-President, Dr. L. V. Redman. Other Directors are: P. A. Thomson, C. H. Taylor, V. R. Smith, and B. P. Corey. Offices are located at 307 York Building, Toronto, with factory at Mount Dennis.

Canadian chemists will be particularly interested in this new industry, as Dr. Redman is very well known in chemical circles, and a graduate of the University of Toronto.

DOMINION ALLOY STEEL OFFERS STOCK

Some $4,000,000 preferred stock is being issued for Dominion Alloy Steel Corporation. They will erect a plant at Sarnia, to manufacture by electric furnace methods, alloy steels for Canadian market. This development has been under way for some time. Mr. Wm. B. Boyd, formerly with the Dominion Iron & Steel Corp., is President of the new Company.

PERSONAL

Mr. F. W. Shulenberger, manager of Eimer and Amend, the well-known laboratory supply house, New York, has returned from an extended four month's business trip, which began with his attendance at the meeting of the American Association for the Advancement of Science, at Toronto last December, continued through several of the southern states, concluding with the Convention of the American Chemical Society, at Birmingha, Alabama, a few weeks ago.

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TABLE OF CONTENTS

EDITORIALS: Page

The Budget ... 121
Collars vs. Overalls 121
Presidents, Secretaries and a Treasurer 122
For Services Rendered 122
Fifth Annual Convention of Canadian Chemists—Report of Annual Meeting, Ottawa, May, 1922 ... 123
How The Institute can Best Serve Canadian Chemists. By John S. Bates ... 125
Letter From Past Secretary to Members ... 126
John Bates (A short sketch of the career to date of the new president) ... 126
Annual Report of Secretary-Treasurer, Canadian Institute of Chemistry ... 127
Supplementary Report of Secretary-Treasurer 128
Technical Photographers Form Society 128
The Manufacture of Cyanogen Compounds in Canada. By Horace Freeman ... 129
The Relation of Iron to Activated Sludge. By George H. Lucas ... 131

Page

Chemical Society News:

"Professional" Engineers Must Wait 134
Toronto Section, Society of Chemical Industry 134
London (Ont.) Chemists and Manufacturers Getting Together ... 134
Shawinigan Section Hears Address on Steel 135
New Aims for Cement Construction ... 135
New Books ... 136
World Conditions and News in Chemical Fields 137
Mining and Metallurgy in British Columbia 139
Latest Chemical and Metallurgical Patents. By A. E. MacRae ... 140
Industrial Items ... 141
National Exposition of Chemical Industries 141
Market Review ... 141
Market Prices ... 142
Buyer's Guide 43
Index to Advertisers 52

FROM THE PUBLISHERS—

BUSINESS CONDITIONS AT LARGE

We may be all wrong about it, but we believe that most business organizations are well over the nervous tension stage into which they were all thrown. The bottom, at least, feels pretty solid right now to most of them. Disconnected and stray voices complain that everything has gone to pieces, but was it not always that way, for many who never did lead or work any harder than the minimum required?

The Canadian dollar, which, after all, is of some importance as an indication of things Canadian, is doing remarkably well. We think we are hearing of more expansion than contraction. Money is coming into the country in considerable amounts, and if the pound keeps rising just a little longer, it should result in a much enlarged interest in Canada on the part of English money. A reasonable return on our agricultural activities, plus a continuation of production in such large fields as mining and pulp and paper, are certain to be reflected in all the minor industries. Boom business can be banished without regret. Normal prosperity can be established, and is here for those who will just settle down to the business of expending their service and skill to meet some ordinary need of the country.

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Dependable Reagents—

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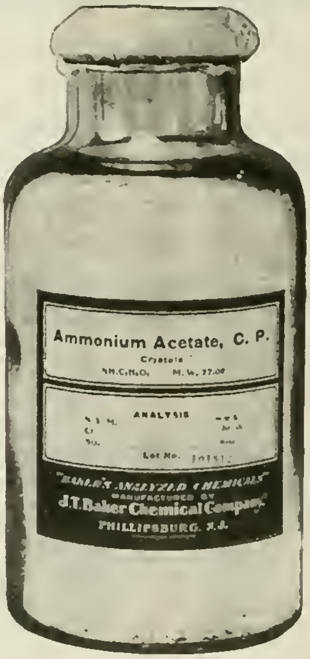

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EDITORIALS

THE BUDGET

IT'S out—Mr. Fielding may now take off that hat, under which for some weeks past, he is said to have stored his thunderbolts.

The measures taken to balance our national obligations will not be unanimously approved. They stave off for many of us that period, or state of bliss, so often referred to as a "return to normal." Is it rational to presume the existence of a normal. There is a normal to a flight of stairs, but we don't want the staircase to resolve itself to normality while we are on it. We prefer those interruptions to normality, known as steps.

The budget shows us that Canada has assumed obligations whereby its per capita expense has increased enormously, and, while this may be reduced to some extent in the course of years, it will never approach the 1913 condition. We are paying the price of becoming a national entity in commerce and communications. We have grown, and we are growing. We are sinking capital in development. All we should wish to be assured of is, that our investments be wisely stewarded to secure us a living income on the new plane.

Business did not stay down to take the count and is slowly but surely fighting dull times to a finish. All the signs point that way, and some matters of fact.

We are tempted to claim that this welcome state of affairs might have been hastened, and may yet be improved by an adequate provision in industry for proper attention to both routine control and scientific investigation. We very strongly urge, as we have before, that Canadian manufacturers would be far better off to finance their own investigation and research. It would be a very small matter as far as any individuals are concerned for Canadian manufacturers to raise enough money to equip, endow, and maintain a system of industrial research and scientific service which would function free from red tape or political exigencies. There are Canadian industries that should be free from any apprehension related to tariffs or budgets. We have enormous iron and coal deposits, unrivalled forests, and power, why fear "what man can do unto us."

Direct taxes are necessary to carry our burden of war debt. It is reasonable to expect that all governments will attempt to distribute this weight evenly. As for minor changes in the tariff, relating to milk bottles and spare parts for special mining machinery, there is no great evidence of the collaboration of scientific minds in the latest creation. Perhaps some day we may find time to re-write the whole customs' tariff, having in mind a more up-to-date wording than that found in the 1907 edition.

COLLARS VS. OVERALLS

MR. EDISON proposed as a test of fitness for college men, that they should be able to answer a fair proportion of one hundred questions. We suggest that the fitness of a man to get along after graduation in science is largely involved in his answer to one question, "Will you report for work to-morrow at seven a.m., with a suit of overalls?"

Many young men have an idea that the University is a short cut to a perpetual working condition known in mill parlance as a "white collar" job. We wish we could shout at all the convocations of Canada to all men who wish to earn a good livelihood as soon as possible after graduation, that there is no more satisfactory route to competency for the University graduate than the overall route. Our industries need chemists and engineers, but have, in many cases, the idea that chemists and engineers want to strut about in laboratories and polished brass engine rooms. The men who run the machines and stir the tubs in our textile and paper mills, tanneries and laundries, have the same views.

There's a gap between the tub and the beaker, that must be filled, and it can be closed only when the man at the tub talks the same language as the man at the beaker. The graduate who gets a laboratory or engine-room job at $150.00 a month, nine to five and tennis after, thinks he's doing well for himself, and perhaps he is, but his classmate who dons the overalls and gets a job—any job—in the mill, at any pay, eight or ten-hour shift, has it all over him in five years or less, provided that he has as much common sense as college sense, a kind heart and the gift of industry.

There are men in the textile trade who never saw the inside of a school, and think a college produces only a lot of sissified high brows, and these men can, in these slack times, demand and get from $60.00 to $100.00 a week as dyers and colormen, and they don't know anything about what they are using. They use it pretty well considering, and the white-collared man in the laboratory is a worm in their sight. A helper clad in overalls and common sense, with a decent respect for the experience they have, and a little knowledge of the aromatic hydrocarbons, plus patience and some after-hours communion with the laboratory, could bridge the gap in the first place, learn a good vocation in the second place, help Canadian industry in the third place, and justify his B.Sc. in the fourth place. We speak from knowledge. It has been done. Only a short time ago a college man with a fair job, but not much prospect, threw up his job, went into a paper mill at the bottom, and, in five years or less, has just been made General Manager. Not all the trees bear such good fruit so quickly, but they certainly bear fruit.

Our advice to the science graduate is to get into the mill, and take the excellent post-graduate courses that can there be had with Professors Boltemdown, the millwright, Blowheroff, the sulphite cook, and Tryapinchmore, the dyer.

PRESIDENTS, SECRETARIES AND A TREASURER

POSSIBLY there is no person other than Professor Watson Bain who could have successfully nursed the Institute baby through its first two years, especially the teething period, which we trust is nearly over. Professor Bain's good humor, patience, courage and optimism meant much in those colicky days.

Now we go from the University to the mill, a pulp and paper mill, and pick out one of the most representative scientists in Canada's most up-to-date indigenous industry. Dr. John Seaman Bates was the first Chairman of the Technical Section of the Canadian Pulp and Paper Association. We believe the election of "Johnny" Bates—as he is called round Woodstock, Ontario—is an evidence of the progressive views of the Institute, and indicates a broad practicality for its future activities.

To Mr. Harold J. Roast as Secretary-Treasurer has fallen most of the drudgery of the nursery. His uniform good temper under fire has been as notable as his persistence, and we can with fair accuracy use in reference to him, the phrase: *suaviter in modo, fortiter in re.* We trust he will soon regain his health and will be interested to see him in action as somewhat of a free lance.

As to the new Secretary we are enjoined to brevity. We think he will do nicely. L. E. has good shoulders mentally and physically.

After using up all our nursery symbolism, it's too bad to land on the new treasurer empty handed of infantile metaphor. Perhaps it's a too prevalent condition with him just now. He's probably worrying already about the new stamp charge on cheques. Professor Alphabet Ardagh has done some liquid leger-de-main. If he does as well with our funds, but with the reaction from left to right only, he will have our benediction.

FOR SERVICES RENDERED

CHEMICAL organizations in Canada have just passed through what may be looked upon as a period of most important development. The individuality and nationality of Canadian chemistry has been asserting itself. The profession is at the moment facing a position in many ways parallel to that which confronted the disjointed sections of the Dominion before they united. Distances make minor interests different and joint action slow. Out of it all will come a united chemical profession, whose status will be recognized and equal to that of other leading professions of technically trained men.

Such developments always tend to link themselves around the activities of individuals. Others have played important parts; but, in the main, a few have carried the burden. Remembering always, those who were jointly active with them as members of Council, and as members of organization committees, it seems to us only right to point out particularly the parts taken by the retiring President and Secretary-Treasurer of the Canadian Institute of Chemistry.

Professor J. W. Bain found time, even though rendering service in a multitude of other directions, to be a most active President of the Institute for three years, during its formation and incorporation. Mr. Roast's activities have an even earlier genesis. He was among the very first who had a vision of this organized future for Canadian chemists. Into this work he threw every ounce of strength and time at his command. The strain of sustained creative organization work is only apparent to those who have passed through such periods.

The work thus begun must broaden. The future contains much worthy of a united expenditure of effort on the part of Canadian chemists. The foundation only has been laid, and perhaps the main lines of the structure drawn. We know that members of the Institute appreciate the constructive efforts of their first President and Secretary; and, unless all signs fail, the chemists of Canada, as a whole, will look back through all future time with a very considerable degree of satisfaction on the work of those connected with the establishment of chemistry in this Dominion on a national professional basis.

The annual convention of the National Lime Association will be held June 14-16, Hotel Statler, Cleveland, Ohio. The technology of the uses of lime, and the industrial problems of manufacturing and marketing will be dealt with.

Mr. T. A. Henderson, for some time manager of the Toronto branch of the National Drug and Chemical Company, has been appointed assistant general manager of the company and will be located at the head office in Montreal.

Fifth Annual Convention of Canadian Chemists

Chemists of Canada Meet at Ottawa May 15th-17th

ONE of the most beautiful cities in Canada was at its its best for the three days' visit of chemists from every province. The Society of Chemical Industry and the Canadian Institute of Chemistry occupied the main stage during the first part of the week, while the very extensive programme of the Royal Society of Canada covered the field of activities in Canadian scientific, historical and literary circles during the latter half.

The chief events on Monday were visits to points of interest around the city, and the meetings of committees. The Dominion Experimental Farm, the Royal Mint, the new Parliament Buildings, and the various laboratories of the Government were all open to visitors. During the day the Associate Committee of Chemists of the Advisory Research Council met, and a full report will be available at a later date. The subjects discussed by the committee were as follows: "Notes on Binding Materials for Briquettes," by Leslie R. Thomson, Esq.: "The Chemical Effect of Alkaline Soil and Water on Concrete in the North-West," by Dr. T. Thorwaldson: "Notes on the Utilization of Refuse Fuel," by Dr. H. E. Pigelow; "Important Problems in Connection with the Pulp and Paper Industry," by Dr. John S. Bates; "Notes on the Manufacture of Cyanogen Compounds in Canada," by Horace Freeman, Esq.; "The Need of Greater Publicity Concerning the Dangers of Carbon Monoxide Poisoning," by Fred. J. Hambly, Esq.; "A Plea for Research in the Textile Industries," by A. Burton. This committee has extended its activities in many ways, and has a considerable amount of research work in hand. In the evening the first meeting of the new Canadian Council of the Society of Chemical Industry took place. Mr. A. Burton, for years the general secretary of the Canadian Section, was chosen as secretary of this council. Mr. T. H. Wardleworth, Canadian vice-president of the society, acted as chairman. This council is designed to co-ordinate the work of the various Canadian sections, and allows the society in Canada to present a united front on matters of general interest. It was really made necessary by the formation of independent sections. Its members are either the acting secretaries and chairmen of sections or the chairman and the immediate past chairman. The last council meeting of the Canadian Institute of Chemistry for the year was held during the evening.

Annual Meeting, Society of Chemical Industry.

General meetings were held at the Chateau Laurier, and Tuesday was devoted to the annual meeting of the Society of Chemical Industry. Dr. R. F. Ruttan, president of the society, delivered an address, in which he presented and developed in full detail the present situation in research work, both industrial and otherwise. He reviewed the annual meeting of last year and events since that time. He stated his belief that if the Senate had a second opportunity to pass the bill granting money for a Research Institute they would be glad to do so, and might now be counted on to stimulate legislation to this end. He pointed out very clearly the necessity of every branch of scientific research work. The universities must continue to keep alive research. This was one of their most important functions. It was necessary to advance at all times work in the fundamental sciences, in the fundamental industrial sciences, and in what is generally known as industrial research. Through educational work, among industrial executives, a greater measure of scientific control and a quicker application of known science could be secured. Probably the high note of a most masterly address was attained when a picture was painted of the time when the necessity for scientific research principles and their use in the world's work was as plainly understood and as broadly applied as is elementary education in most countries at the present time.

Members of the Canadian Institute of Chemistry and the Society of Chemical Industry, together with lady guests at annual meeting, Ottawa. Photo by courtesy of Photographic Stores, Limited, Ottawa.

Following this address, and arising from the general business of the Annual Meeting, the invitation of the Chemists of Toronto, as presented by Mr. M. L. Davies, Chairman of that section, that the next annual meeting be held in that city was adopted.

Five papers were presented: "The Operation of Koppers By-Product Oven Plant," by C. E. Wallin, Superintendent of the coke oven plant of the Dominion Iron and Steel Co. This paper was illustrated with slides and traced the remarkable efficiency of the plant now in operation at Sydney. Conditions which altered the yields of various fractions were considered and the effects of heating conditions in the ovens were pointed out.

Mr. F. E. Lathe, chief chemist of the British America Nickel Corporation, gave a paper consisting of notes on analytical problems peculiar to the metallurgy of nickel. Dr. J. W. Shipley presented the results of some very interesting work carried on at the University of Manitoba, in connection with the destruction of cast-iron pipes in the soils underlying the city of Winnipeg. The theory that the effect was due to stray currents from the electric street railway has not been found correct, as the deterioration is found at great distances from grounded wires and has been demonstrated to be due to the nature of the layers of clay in which pipes are placed. Both iron and lead are affected. Samples of pipes were shown and the results of experiments designed to parallel, in part at least, soil conditions, were given. The corrosion has been very complete. Preventions may be possible by dipping the pipes in a suitable protective paint, possibly of a tar nature, or by producing an alloy that will withstand the action of the salts in the soil.

R. T. Elworthy presented a paper, outlining some work that had been carried on at the Department of Mines on Chemical Products from Natural Gas. The possibilities were very enticing, but the experimental work carried on so far had been somewhat negative. The apparatus used was illustrated.

J. A. M. Dawson, Analyst-in-Charge of the Food and Drug Laboratories, Vancouver, contributed a paper on the production of loganberry juice, giving some constants secured by an examination of the commercial product. The production of this fruit juice has been increasing and may become an important industry. Climatic conditions in British Columbia are ideal for the cultivation of the plant.

During the evening, a smoker was held at the Rivermead Golf Club. Under the able direction of Mr. Bates and the local entertainment committee, some good fun was produced, under the chairmanship of Dr. Harold van der Linde.

Annual Meeting, Canadian Institute of Chemistry.

Wednesday was entirely devoted to the affairs of the Institute of Chemistry. Mr. Roast, Secretary-Treasurer, presented his annual report, which is given in full elsewhere. Membership in the Institute has steadily increased, and a very lively interest in Institute affairs was indicated by the number of members present, and their participation in discussions regarding the business and policy of the Institute.

Mr. S. J. Cook presented a statement of chemical statistics compiled specially for the Convention, showing the very latest data available. He also presented a report on the salaries paid and money earned by members. These averages were very good, showing that a number of chemists at least were well above the $5,000 mark. This report will be presented to members by the Institute. Various matters relating to the chemical profession were discussed, including the question of legislation and the formation of more active self-contained local sections.

Mr. C. Lodge, Chairman of the Publicity Committee, gave a paper dealing with the necessity for this work and urged members to accept responsibility as individuals.

The Institute suffers a very considerable loss in the resignation of the Secretary-Treasurer, Mr. H. J. Roast, who, from the original organization committee, has carried on the work of the Institute in a most unselfish and energetic manner. It was with the greatest sympathy and regret that the members learned that Mr. Roast, on the advice of his doctor, following a recent forced rest in Bermuda, had decided to withdraw. The new members of Council elected as announced were: Dr. John S. Bates, Bathurst, N.B.; Dr. A. T. Charron, St. Hyacinthe, P.Q.; Dr. A. C. Neish, Kingston, Ont.; Dr. T. Thorwaldson, Saskatoon, Sask.; and F. G. Wait, Ottawa. Dr. J. S. Bates was elected President for the coming year, with Prof. E. G. R. Ardagh as Treasurer, and L. E. Westman as Secretary.

The Annual Dinner of the Institute was held at the Chateau, with the ex-President, Prof. J. W. Bain, presiding, in the absence of Dr. Bates. Among those present, who spoke, were: Hon. Jacques Bureau, Minister of Customs and Excise, who gave evidence of a very strong appreciation of the place of chemistry in industry; Mr. J. H. Harris, M.P.; and Mr. W. C. Good, M.P., also spoke in reply to the toast of "Our Guests," proposed by Prof. M. A. Parker.

Mr. M. L. Davies handled the Canadian Institute and Prof. H. E. Bigelow proposed the S. C. I., with Mr. F. Hambly replying.

Sister Societies, of which the Institute recognizes two, namely, the Engineering Institute of Canada and the Canadian Institute of Mining and Metallurgy, were represented by Mr. K. M. Cameron and Mr. R. L. Peek. Mr. S. J. Cook welcomed them among the chemists.

Prof. E. G. R. Ardagh and Col. J. T. Janson represented the ladies and it appears that they also had had a most enjoyable time under the guidance of the Ladies' Committee. A very successful Annual Meeting was closed with the presentation to Mr. Roast, by Dr. L. F. Goodwin, on behalf of the members, of a beautiful silver vase. Dr. Goodwin was closely associated himself with the establishment of the Institute and reviewed briefly the work Mr. Roast accomplished in its organization.

COMMITTEES OF THE CANADIAN INSTITUTE OF CHEMISTRY.

Following the Annual Meeting, the Council of the Institute met and appointed the following Committees:—

Finance Committee—Dr. J. S. Bates (Chairman), Prof. E. G. R. Ardagh and Prof. J. W. Bain.

Papers Committee—Prof. W. Lash-Miller (Chairman), Prof. A. C. Neish, Prof. T. Thorwaldson, F. G. Wait and Prof. R. F. Ruttan.

Legislation Committee—H. J. Roast (Chairman), Dr. A. T. Charron, Dr. A. E. MacIntyre, Prof. L. F. Goodwin and J. A. M. Dawson.

Examining Board—Dr. J. S. Bates (Chairman), Prof. Georges Baril, Prof. E. G. R. Ardagh and F. J. Hambly.

Publicity Committee—W. C. Lodge (Chairman), Prof. H. E. Bigelow, L. T. Acton, Horace Freeman and L. E. Westman.

Publications Committee—Dr. J. S. Bates (Chairman), Prof. A. C. Neish and I. C. Mackie.

Remuneration of Chemists—S. J. Cook.

Nomination Committee—Prof. A. L. F. Lehmann (Chairman), Prof. M. A. Parker and F. G. Wait.

Employment Bureau—The Employment Committee consists of a member of Council for each Province, with Prof. G. S. Whitby of McGill University acting for Quebec, and the Secretary, L. E. Westman, for Ontario. Thus the other members on the Committee are: I. C. Mackie, Nova Scotia; Dr. J. S. Bates, New Brunswick and P.E.I.; Prof. M. A. Parker, Manitoba; Prof. T. Thorwaldson, Saskatchewan; Prof. A. L. Lehmann, Alberta, and J. A. M. Dawson, British Columbia. The success of the work of the Employment Bureau depends entirely upon the number of applications received from manufacturers and others seeking chemists. The members will be doing a good work if they will send forward full particulars of all openings to some member of this Committee.

The report of Mr. S. J. Cook on the remuneration of chemists within the Institute will be available for all members at an early date.

How the Institute Can Best Serve Canadian Chemists

By John S. Bates.
President, Canadian Institute of Chemistry.

IT is a significant fact that the call this year was again for papers dealing with Institute affairs, rather than chemical topics. We are still very much in the development stage, and wish to find the way to sound growth. The present paper gives merely a bird's eye view of the field, with the idea of stimulating discussion by the members. The remarks are brief, but emanate from a deep faith in the future of the Canadian Institute of Chemistry.

The Institute was founded, because Canadian chemists wanted a united professional organization, which could be controlled to suit the needs of the country. The sound basis of organization lies in the Charter and by-laws adopted a year ago. First and foremost, we represent the profession of chemistry in Canada. At the same time, no activity affecting the general uplift of chemistry should be overlooked by the Institute. We can broaden our interests without changing our system.

A parallel in a nearby field is the Engineering Institute of Canada, which has developed through years of growth. This professional institute is now serving engineers and the public in a way that we might well follow as a guide and, in fact, our constitution is modelled rather closely along the lines of the Engineering Institute. It is of interest that the Canadian Mining Institute is turning more in the direction of industrial activities, partly to avoid needless overlapping. In our own field, the Society of Chemical Industry was the first to spring up in Canada, and has filled an important place. Needless to say, the Canadian Institute of Chemistry looks to co-operation of effort, because the chemists are largely the same individuals in the two groups, and should develop each organization along lines of natural growth to reap the greatest total good. In the democratic country to the south, the American Chemical Society has attracted not only chemists, but also many with a general interest in chemistry, and has been without equal in service rendered. Now there is rising a feeling that the best results can be attained by drawing some distinction in favor of qualified chemists.

Importance of Sectional Meetings.

How can our Institute best serve the Canadian Chemist? Knowing something of human nature, I would say that the most important move is to give full value to our members for the fees which they pay. There is danger of over-reaching ourselves towards ultimate aims, forgetting that the shareholders want some dividends now. First on the list, I would place meetings. The members want to hear chemical discussion on Canadian problems, and nothing can take the place of meetings in arousing personal interest. The Annual Convention is useful, as far as it goes, but a system of sectional meetings throughout the year in different parts of the country is needed. Where there is already a scheme of bringing chemists together, the Institute should co-operate. The reading of papers raises the question of publishing. *Canadian Chemistry and Metallurgy* is the official medium of the Institute and provides a ready, inexpensive means of distributing both papers and proceedings. Other proposals are being raised, and it remains to be seen whether a joint scientific publication can be economically produced in Canada. Another suggestion for service is the formation of committees on chemical problems which are of major importance in Canada. A standing committee on finance and other executive matters is necessary; but concerted attention should be given to those chemical subjects which can best be advanced by specialists among our members. The Employment Bureau is another important aid to chemists, as well as to employers, and should be a permanent feature of the Institute. The maintaining of a library is more doubtful, and is overshadowed by the need for one comprehensive science library for Canada.

The Chemists and the Public.

In a different class are those activities which have to do with the relation of the chemists to the public, and to the law. Should we not further strengthen the organization and chemical service of the Institute before expecting to carry our influence very far outside? Legislation is one of the ultimate aims, and plans should be made for systematic action, as the opportunities arise. The engraved diploma, now being discussed, will some day be less prized than the registration card bearing the title of Professional Chemist. Remuneration is a live subject, and no doubt something can be done to raise at least the minimum standards. Chemists can do a great service by telling the public what chemistry is doing for the development of the country. Such publicity is already started, and will surely react to the benefit of the chemist. The Institute also provides a body that can speak with authority to the Government on national questions in which chemistry is involved. World-wide co-operation is now being carried on through the International Chemical Union, but the Institute is perhaps a little young to attempt very much in this direction.

Canadian chemists are a small body, but the right spirit can work wonders. The means are personal enthusiasm on the part of the members, and a plan of directing these energies to the best advantage. The needs of chemists should be voiced by the membership at large, individually, by committees, and through local branches. General policy is then dictated by the majority wish of the membership. The scattered Council is a clumsy board of directors for efficient action, and this defect in our organization should be recognized. A suggestion is offered that each council member function mainly as the leader in his own district to advance the particular interests of chemists in that section of the country. The real executives are the President and the Secretary, and the progress of the Institute rests largely with them in finding out the wishes of the Council and members, and then carrying these decisions into effect. In this connection, I would like to pay a tribute to the retiring President, Professor J. Watson Bain, and to the Secretary, Mr. Harold J. Roast, for their painstaking services. Some time in the future it may be possible to have a paid Secretary. In the meantime, there is much that we can do at small expense, provided each individual member gives his share of effort.

Formation of Branches is Desirable.

Looking back over the suggestions that have been made, it will be seen that some developments in organization are needed. The holding of meetings is mainly a local matter, and branches of the Institute might well be formed in each convenient section of the country. This is already provided for in the by-laws and will bring together each group of members for united activity. In fact, the real strength of the Institute will be found in the enthusiastic work of these local branches. Part of the money paid in central dues might be returned for branch use. The widening of the Institute influence could also be accomplished by allowing such branches to include those with a general interest in chemistry as local affiliates, without disturbing the professional status of the Institute as a whole. To carry out special aims, such as provincial legislation, the natural out-growth from the central Institute and the local branches would be the formation of provincial associations of chemists, not as official divisions of the Institute, but having the support of our organization.

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*Paper prepared for Annual Meeting Canadian Institute of Chemistry, Ottawa, May 17, 1922.

No doubt there are other ways in which the Institute could serve the chemist and the public. These should be made known, and members should deem it their duty to assist the officers and the council with constructive suggestions.

LETTER TO MEMBERS OF INSTITUTE.

393 Guy St., Montreal, P.Q., May 20th, 1922.

To the Members of the Canadian Institute of Chemistry:

Gentlemen,—I wish to take this opportunity of thanking the membership for the expressions of appreciation and goodwill that are embodied in the handsome gift presented to Mrs. Roast and myself on the occasion of my resignation as Secretary-Treasurer.

My reason for resigning, as stated to the new Council after my re-election (and for reasons due to existing by-laws, it was impossible to give notice of resignation to the old Council) was the matter of health.

During the last four years the organization of the chemical profession in Canada has made increasing demands in time and energy upon those taking part in the same, and it is reasonable to expect that this will continue as the years go on.

It is for this reason, and because my position has enabled me to appreciate more than most of you the labor involved, that I ask for your loyal support of my successor, Mr. L. E. Westman.

As member of Council and Chairman of the Legislation Committee I shall, of course, continue to do my best to further the interests of the Chemical Profession in Canada.

Yours sincerely,

HAROLD J. ROAST.

DR. McMURRICH HEADS ROYAL SOCIETY.

Professor J. Playfair McMurrich, Professor of Anatomy at the University of Toronto, was elected President of the Royal Society of Canada at the annual meeting held at Ottawa, May 19th; Dr. Charles Camsell, Ottawa, was elected Honorary Secretary. Officers of the Mathematics, Physics and Chemistry Section were elected as follows: President, Prof. J. W. Bain, Toronto; Vice-President, Dr. J. S. Plaskett, Toronto; Secretary, Mr. J. Patterson, Toronto.

LEATHER CHEMISTS TO MEET IN CANADA.

The American Leather Chemists' Association will hold its 19th Annual Meeting at Bigwin Inn, Lake of Bays District, Ontario, June 21 to 23, inclusive. This association is one of the most important of associations of technical chemists in the United States and includes in its membership several Canadian chemists.

JOHN BATES, Ph.D., F.C.I.C.

President Canadian Institute of Chemistry

The second president of the Canadian Institute of Chemistry was born at Woodstock, Ontario, in 1888. In 1908, he graduated from Acadia University, with the degree of B.A., and in 1909, secured the degree of B.Sc. Post-graduate work in chemical engineering was followed at Columbia University, and the chemical engineer's degree taken in 1913. In the following year, he secured his Ph.D., at Columbia, also. His experience has been for the most part in pulp and paper work, beginning with the Union Bag & Paper Co., at Hudson Falls, N.Y., during the summers from 1911 to 1913. Following this, a year was spent in the laboratories of Arthur D. Little, Inc., at Boston. About that time, the Dominion Government was actively developing the Forest Products Laboratories of Canada at Montreal, and Dr. Bates was appointed superintendent, remaining in this position from 1914 to 1919. In addition to this work, he was connected with the Explosives Department of the Imperial Munitions Board, and, during the years 1916 to 1918, he assisted in the production of war chemicals, acting in the capacity of a consulting chemical engineer. In 1919, he became technical superintendent for Price Bros. & Co.,Ltd., at Kenogami, Que. During the past year, he has been in charge of the chemical engineering work of the Bathurst Co., Bathurst, N. B.

During this whole period, he has been very active in the work of engineering and technical associations. From 1915 to 1919, he was chairman of the Technical Section of the Canadian Pulp & Paper Association. From 1918 to 1922, he was a member of the Associate Committee on Chemistry of the Advisory Research Council. He is an Associate Member of the Engineering Institute of Canada, and at various times, has been active in committee work in other scientific societies. This experience has been a very complete training for the highest office at the disposal of the professional chemists of Canada.

Annual Report of Secretary-Treasurer, Canadian Institute of Chemistry

TO the members of the Canadian Institute of Chemistry, assembled in Ottawa for the Third Annual Meeting, May 17th, 1922.

This report covers the period from August 1st to December 31st, 1921. Hereafter according to the By-laws, the Annual Report will deal with the period from January to December of each year.

The activities of the Institute have been represented by the following committees: Finance Committee, Papers Committee, Publicity Committee, Remuneration Committee, Employment Bureau, Nomination Committee, the Examining Board, Legislation Committee, Publication Committee, International Chemical Union Committee. The membership of these committees will be found in the Institute's booklet, page 7.

Membership.

There has been a slight increase in the number of Fellows during the last three months of the year 1921, total being 166, as against 156. A larger increase has been made in the Associates, which number 39 as opposed to 22. The greatest activity is, however, shown in the number of student members. Whilst some attempt had been made prior to the last Annual Report to form student branches, no definite registrations were available at that time. We now have 50 student members on the register. It is from this student membership that the Institute must expect to derive most of its Fellows and Associates, and it is believed that every attention should be paid to this class of membership.

Queen's University has taken the lead in this regard, having 35 student members, the University of Toronto follows next with 13. In connection with McGill University it was thought best to wait until the session of 1922 to 1923 opened, in the meantime the Institute has secured a substantial representation amongst the Professors in the Department of Chemistry in McGill as members and it is hoped that a large student body will come into being next Autumn. We have one representative of the Works Chemist as a student member and it is felt that this division might well be added to. Amongst the many laboratory assistants there must surely be several who have an interest in the profession and who might be encouraged to take college courses and so qualify as trained Chemists. Fellows and Associates in the Institute who have such men under them might stir up interest along this line.

Employment Bureau.

The activities of the Employment Bureau have been very one sided, that is to say, the number of applications received from Chemists desiring positions have been far in excess of the few positions secured. It is felt that a special committee is needed to deal with this question of employment. What is required is that the existence of the Employment Bureau of the Institute be brought more forcibly before the employers of Chemists in Canada so that it shall become a matter of course to write the Bureau whenever a Chemist is needed. It would probably be advantageous to have a member of the Employment Bureau Committee in each of the larger centres of Chemical activity. It is still a noteworthy fact that there are only some five or six members of the Institute on the Employment Bureau register, the remaining 30 or 40 names being Chemists who are not members. To show that some satisfaction has been given by the Employment Bureau, two letters may be cited (letters read by Secretary).

Publicity.

A definite start has been made in regard to systematic publicity by the members of that committee, from whom we shall hear during the Annual Meeting.

Remuneration of Chemists.

The Remuneration Committee got out a questionnaire during the year and has a report to submit which will be read later.

International Correspondence.

The Empire Associations of Chemists, with which the Institute is in correspondence, are the Institute of Chemistry of Great Britain and Ireland, the South African Chemical Institute, the Indian Institute of Science and the Australian Chemical Institute. Correspondence is also established with the Chemical Society of Belgium and the Polish Chemical Society. The Institute's Journal has exchanged with all these Associations and copies of their publications are on file at the office of the Institute.

International Chemical Union.

The International Chemical Union is meeting this year at Lyons, France, at the end of June. We are fortunate in having two representatives at this Congress, Dr. R. F. Ruttan and Dr. A. T. Charron; a report will be submitted from these gentlemen upon their return from the Congress and the same will appear in the Journal of the Institute in due course. Canada is fortunate in having such a representation through the Institute at this International Congress, particularly in view of the fact that the cost to the Institute is merely nominal.

Financial Statement.

The books of the Institute have been audited by Mr. Llew F. Sims, C.G.A., Certified Auditor and Accountant, the original of whose report is attached. This shows the surplus as at December 31st, 1921, $1,989.24. This surplus is as follows: Cash on hand being $1,589.72; Library, $37.27; office furniture and, fixtures less depreciation, $362.25. This is the first financial report that has been made at the end of the calendar year and consequently cannot be directly compared with other reports which have covered shorter or longer periods. The income of the Institute becomes payable and is practically all received in the month of January, so that all expenses for the ensuing eleven months have to be deducted from the income of the first month, as a result the only satisfactory statement that can be rendered is one covering a period from January to December, as provided for in the present By-laws.

Office Activity.

The simplest way of summing up this feature of the Institute's work is to say that during the period August to December, 1,040 letters have been sent out, or an average of 10 for every working day.

Conclusion.

While the depression of 1921 has been shared by the Chemists in common with all professions and businesses, we may be encouraged by the present signs of renewed development that are becoming evident, and may look forward with a fair degree of confidence to more satisfactory conditions in 1922.

In order that the Institute may continue to make satisfactory progress, and consequently be of greater use to its members, more activity is needed in the various standing and special committees and an all-round interest of the general membership rather than the concentrated effort of one or two.

This report is presented in the best interests of the Canadian Institute of Chemistry by

HAROLD J. ROAST,
May 17th, 1922. Secretary-Treasurer.

SUPPLEMENTARY REPORT OF SECRETARY, CANADIAN INSTITUTE OF CHEMISTRY, COVERING PERIOD FROM JANUARY 1ST, 1922, TO MAY 17TH, 1922.

Annual Dues.

The collection of the annual dues for 1922 has been particularly gratifying and well worth the labor expended in securing the result. Out of the 205 Fellows and Associates, only one has decided to resign and one other has asked for a delay in making the payment of the annual subscription, which delay has been granted, whilst the remaining 203 members have paid in full. It would appear from this that the dues of the Institute are reasonable in the eyes of the members and that, notwithstanding the particularly bad year through which we have passed, it has still been possible to maintain the membership fees.

Special Expenses.

Since the close of the official year of the Institute, in December last, certain special expenses have been incurred which were duly approved by the Finance Committee. One item was the purchase of an Addressograph amounting to $90. The most important feature of this is that the official addresses of the members of the Institute are duly recorded on stencils which will always remain the same until changed by notice from the member. This facilitates the getting out of circular matter to the members and should result in more frequent circularizing and therefore greater interest in the Institute. It also assures all members of receiving their communications correctly addressed.

The other special expense was that of $447.29 for the Institute's booklet. In this connection some explanation may be necessary, not for the cost of the publication, but for the delay in its appearance. It was decided after the Annual Meeting, on August 29th, 1921, that not only should the By-laws be printed, but that it was desirable to have in the same book a list of the members and their addresses, together with their specialties. Owing to the fact that all the records were in the Secretary's office, it naturally devolved upon him to collect the data for publication, further, it seemed desirable that a membership of over 200 be secured before publishing the book and it was not until the end of December that this result was obtained. It was found that it took considerable time and correspondence to secure the specialties of the various members, particularly on account of the fact that only a few of the members had filled in satisfactorily clauses 17 and 18 of the application forms. Following on this the Secretary had to go South for an enforced holiday for a period of one month. As a result of these combined delays the booklet was only mailed to the members on May 2nd. Copies of the booklet have been sent to all the important Boards of Trade of Canada and to all the Universities, accompanied by the following letters (letters read by Secretary).

It would seem from the correspondence received that the publicity obtained by this distribution of the booklet will have a good effect in acquainting the business men of Canada with the advantages to be derived from the application of chemistry to manufacturing operations, as also with the benefit of basic research on which all industry depends.

Membership.

Some seven or eight new members have been admitted to the Institute since January 1st, and it is hoped that through the year the membership will be substantially increased. This depends essentially on the general activity of the members themselves.

Ballot.

On May 2nd, the ballots for the election of Members of Council were counted by the scrutineers. The result will be announced later on at this meeting, in accordance with the By-laws.

Finance.

The balance in the current account in the bank at this date, May 17th, amounts to $646.10. This includes the payment of the cost of the booklet and all other expenses to date and leaves sufficient balance to complete the year 1922 on the usual basis of $10 a week for stenographic service and $10 rent inclusive of telephone, with a balance of $276.10 for sundry expenses. As a result there should be no need, unless some special expense is incurred, to break into the reserve fund, which is deposited in a Savings Account. This reserve is $1,000, bearing interest at the rate of 3 per annum.

Conclusion.

The Institute may be safely said to have passed its first stage of development, namely, Organization. It is now ready to enter upon the work for which it was created, that is, "To raise the profession of Chemistry to its proper position among the other learned professions," and "To look after and promote the professional well-being and interests of Chemists," all in order to "protect the public" and to assist in the development of the Dominion of Canada.

HAROLD J. ROAST,
Secretary-Treasurer, Canadian Institute of Chemistry.
May 17th, 1922.

These two reports were adopted by the unanimous vote of the annual meeting.

TECHNICAL PHOTOGRAPHERS FORM SOCIETY

The Technical Photographic and Microscopical Society was fully organized at a meeting held in the Chemists' Club, New York, on May 10. The nucleus of the organization was formed at the annual meeting of the American Paper and Pulp Association in April. It is planned to hold a general convention of industrial and microscopical photographers in connection with an exhibition of photographic work, chemicals and apparatus to be held at the Grand Central Palace, Lexington Avenue and Forty-Sixth Street, New York, during the National Exposition of Chemical Industries, September 11 to 16, 1922.

James McDowell, of Sharp & Hamilton Mfg. Co., Boston, was elected president, John H. Graff, of the Brown Company, Berlin, N.H., and Bennett Grotta, of the Atlas Powder Company, Tamaqua, Pa., were chosen vice-presidents, while Thomas J. Keenan, editor of "Paper," 251 West Nineteenth Street, New York, was elected secretary-treasurer.

PERSONAL

Mr. Charles O. Lovett has resigned his position as engineer of tests and field erection with the Buffalo Foundry & Machine Co., Buffalo, N.Y. Mr. Lovett was in active charge of the research laboratory of this company, having been with them for about fifteen years.

The Manufacture of Cyanogen Compounds in Canada*

Development of Processes from Experimental Stages to Commercial Success

By Horace Freeman.

THE existence of a large nitrogen fixation industry in the Dominion is not generally known to Canadians. The establishing of the manufacture in this country is not due to present Canadian demand for the products, which are mostly shipped to the United States, but to the large blocks of cheap electric power available here at the time of the purchase by an American corporation from German interests, of patents covering the cyanamide process of fixation.

It was the establishment of this manufacture in Canada that induced me while resident in Vancouver, B.C., in 1912, to investigate the possibilities of producing cyanides from cyanamide, there being a growing demand in the Dominion for nitrogen compounds in this form, and the further possibility of an export market to the United States and Mexico, which consume large quantities for gold and silver extraction, and for fumigating citrus fruit trees. The cyanide hitherto sold was a comparatively expensive article, being derived from anhydrous ammonia and metallic sodium by the Castner process. I was informed by the manufacturers of cyanamide in Canada, that they were already in possession of the details of the process which had been developed up to a certain point in Germany. By fusing salt with calcium cyanamide a crude cyanide was produced. The American manufacturers of cyanamide desired a process to refine this low grade crude material before attempting its manufacture. In view of these statements and knowing that the crude cyanide could be economically converted into pure sodium ferrocyanide, my attention was directed to means for obtaining sodium cyanide from the ferrocyanide. A known process for this purpose consisted in fusing the ferrocyanide with metallic sodium but metallic sodium was not readily available in Canada.

Investigating Ferrocyanide Process.

Investigation of the properties of sodium ferrocyanide disclosed some interesting features. The salt at normal temperatures does not respond to the usual tests for iron and its composition is best described as the sodium salt of hydroferrocyanic acid. When the crystalline salt is gently heated it loses its water of crystallization and a pale buff colored powder remains. At 200°C. the color brightens perceptibly to yellow and on cooling the reverse change takes place. At 300°C. slight decomposition begins in the presence of air. The change in color led to the supposition that a change in molecular composition had taken place and at the higher temperature the composition might be actually that of a double cyanide of sodium and iron thus:—

$$Na_4FeC_6N_6 \rightleftarrows 4NaCN.Fe(CN)_2.$$

Following this supposition I succeeded in dissolving anhydrous ferrocyanide in a bath of fused sodium cyanide protected from the action of oxygen. A clear solution was obtained, yellow to brown according to concentration, which was regarded as a solution of ferrous cyanide in sodium cyanide. Attempts to electrolyse the fused solution resulted in the splitting up of the iron cyanide portion, giving pure cyanogen gas at the anode and metallic iron at the cathode, and leaving an increased residue of sodium cyanide. Obviously one-third of the cyanogen in the ferrocyanide would have to be treated for reconversion to alkali cyanide.

At this time poison gases for warfare were in demand. In view of the possibility of utilizing this method for producing both cyanide and cyanogen, experiments were undertaken by the Trench Warfare Committee of the British War Office to ascertain the toxic properties of cyanogen. It was found that the gas, although intensely poisonous, was not suited for purposes of warfare because a concentration greater than 0.1% would be necessary and it was impracticable to produce the large quantities that would be required.

It now developed (1915) that the blockade against Germany had caused a serious shortage of cyanide on this continent. One of the large mining companies operating in Mexico made arrangements with the manufacturers of cyanamide to make commercial trials of the crude cyanide for silver extraction. A commission had been sent by the cyanamide manufacturers here to Germany in 1914 to investigate the German methods of making this crude cyanide, but the report brought back showed that the process had not been worked out to an economical degree and the highest grade product produced there contained less than 13% as sodium cyanide. The best that could be said of the operations at Trostberg and Spandau was that the process might have an undiscovered value. This report and a supply of raw lime-nitrogen was sent to me at Vancouver, for the purpose of making a study of the chemistry of the reactions involved.

Calcium Cyanamide and Sodium Chloride Method.

When lime nitrogen (crude calcium cyanamide) is fused with sodium chloride, double decomposition takes place and sodium cyanamide is formed. Very considerable foaming also takes place as is mentioned in the first patent on this subject granted to Erlwein and Frank. This I found was so continuous and so obviously involved a loss of nitrogen content that before a commercial process could be developed, means would have to be taken to prevent it. It was established that in the presence of chemically active carbon, sodium cyanamide will combine with the carbon at high temperatures to form cyanide quantitatively. In the absence of chemically active carbon sodium cyanamide decomposes at a high red heat and nitrogen is lost. There is always in lime-nitrogen sufficient free carbon for this reaction but the carbon is semi-graphitic and not sufficiently active. Acting on this presumption I added various forms of carbon to the mixture of salt and lime nitrogen. This carbon was incorporated in various ways, sometimes by grinding the mixture with pitch in the presence of an oil, sometimes by adding lampblack, coal dust, petroleum coke, or charcoal. When care was taken to prevent admission of absorbed gases and to secure sufficient admixture, no foaming of the fused masses occurred.

With this objectionable feature overcome, it was now possible to pay attention to the amount of salt used in the fusion. From two to four times the theoretical quantity was used by the Germans in order to secure efficiency of transformation of nitrogen to the cyanide form. Another feature involved was reversion of the reactions forming cyanide. The sodium cyanide once formed, reacted while cooling, with the calcium chloride (the other product of the double decomposition) re-forming calcium cyanamide and carbon and sodium chloride. The remedy for this appeared to be rapid cooling because the reverse reaction takes place slowly. Also the temperature for maximum yield was ascertained to be in the neighborhood of 1350°C. or about four hundred degrees higher than was used in Germany. This was one of the first points ascertained in the work at Vancouver, and was very important because it was declared in the German report that a higher temperature than 960°C. would decompose the cyanide. It also affected the design of apparatus to be used for handling such corrosive mixtures as chloride and cyanide. I found that by overcoming the foaming, approximately 90 parts of salt could be used with 100 parts of lime-nitrogen which is approximately the theoretical proportion. Next, by heating to 1350 C., and rapidly chilling the iron crucibles containing the mixtures, the efficiency of nitrogen transformation to cyanide was 94 and the product contained up to 36 of cyanide calculated as sodium cyanide. All the evidence available indicated that such a product could be used directly for precious metal extraction, as it contained three times the percentage of cyanide present in the German product, already shown to be suitable for the same purpose. Arrangements were made (October, 1915) to translate these results into commercial operation at Niagara, Ontario. At the same time a commercial trial was made of the German method. The latter was carried out in tilting furnaces constructed with electrodes as an integral part of the walls, and was soon abandoned owing to the fluxing of the walls by the current travelling through them and largely avoiding the charge between them. The product was also too low grade.

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*Paper presented to Chemists' Committee, Advisory Research Council, Ottawa, May 15, 1922.

It was found in using these tilting furnaces that the foaming could very readily be overcome by adding powdered calcium carbide to the mixture. Its action was not at first understood as it contained no free carbon. It was thought to be due to the carbide combining with escaping nitrogen. Experiments were made by fusing sodium chloride with carbide in the entire absence of nitrogen, and it was established that a reaction occurs at the temperatures used in the cyanide furnaces, by which sodium is liberated and free carbon and calcium chloride are also formed. Many pounds of pure sodium metal were distilled and condensed from this reaction which must also take place in the cyanide furnaces when carbide is used to stop the foaming. Nascent carbon is formed at temperatures above a red heat, which is not easily possible by other means and therefore carbide is the most suitable carbonaceous substance to use for the purpose.

Successful Commercial Process.

The German process was soon abandoned and the results obtained in Vancouver were put into commercial practice at Niagara. The process is now carried out by mixing raw lime nitrogen, rock salt and powdered calcium carbide. The mixture is fed into large crucible shaped electric furnaces, lined with carbon blocks. The furnaces are wide at the top and constricted at the bottom, having a single centrally hung graphite electrode 12 ins. diameter, the lower end being about twelve inches from the bottom of the crucible which is also electrically connected. Single phase current is used. A tap hole leads from the extreme bottom of the crucible and is closed with an iron plug on a long rod. The furnace is filled with raw materials to a depth of several feet and as no foaming takes place and all heat is generated at the bottom, no gases or flames escape from the top of the furnace and the intense heat of the operation is not apparent until the furnace is tapped. A very high current density is employed so that the heating of the mixture between the end of the electrode and the bottom of the furnace is extremely rapid. As the mixture melts the conductivity rapidly increases and the current correspondingly increases. When the current reaches a certain fixed upper limit, corresponding to a known temperature of the fused cyanide inside the furnace, the tap hole is opened by withdrawing the plug. The fused material flows down a conduit to a sump from which it is rapidly taken up and cooled from its temperature of over 1300 C. by means of a rotating steel wheel having continuous water circulation through hollow shaft and rim. The temperature is reduced to a black heat by this means in a few seconds. The material is removed in the form of thin flakes by a scraper and packed in sheet iron or steel drums.

After a batch of material is tapped from the furnace the superimposed layer of partially heated material falls down and takes its place. The electrical contact is not broken so that the temperature again rapidly mounts and the operation repeated. The furnace is thus kept under complete electrical and heat control and is mechanically operated except for the necessary attendant for tapping, who watches the ammeter.

The success of this crude cyanide in gold and silver extraction, and in the preparation of hydrocyanic acid for fumigation purposes, has been so great and the cost of production so reduced, that attempts to refine it and produce high grade cyanide have been abandoned.

Some controversy has arisen with regard to the state in which the cyanide exists in the product. My own contention is that it is present as sodium cyanide and it was on this presumption that the process was successfully developed. It cannot be disputed that double decomposition takes place between sodium chloride and calcium cyanamide when these are fused together. The belief of Erlwein and Frank, and later of Landis in the United States, that the sodium chloride merely acts as a "flux" and enables calcium cyanamide to take up an extra atom of carbon forming calcium cyanide which is supposed to dissolve in the fused sodium chloride, is not borne out by our knowledge of calcium cyanide. This substance (calcium cyanide) is known to exist as a stable compound only in dilute aqueous solution. It has never been isolated as a solid substance. It is well known that solutions of calcium cyanide, when boiled, yield all the cyanogen quantitatively as hydrocyanic acid, whereas solutions of the product of this process do not do so. In fact, only a small amount of hydrocyanic acid is obtained. It is not logical to suggest that the calcium cyanide reacts with the sodium chloride forming sodium cyanide when the melt is dissolved in water, if this reaction has not taken place during fusion at high temperatures. There is the further evidence that on boiling solutions of the crude cyanide with a ferrous salt, a quantitative yield of sodium ferrocyanide free from calcium ferrocyanide is obtained.

With regard to statements that other fusible salts than alkali metal chlorides, such as calcium chloride or sodium carbonate, can be used as so called fluxes, I have not found it possible to produce any cyanide at all in cases where precaution is taken to totally exclude alkali metals.

Sodium carbonate results in infusible masses containing cyanates which cannot be used for metal extraction. Sodium sulphide used in place of salt forms undesirable sulphocyanates. Merely heating commercial lime nitrogen and carbide at high temperature in the absence of alkali metals and rapidly cooling results in the formation of no cyanide at all. In short, for the production of cyanide from cyanamide sodium chloride is the only practicable alkali metal salt to use commercially.

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The Relation of Iron to Activated Sludge

By George H. W. Lucas.

DURING the activation of sewage in an iron tank at the Experimental Station, Toronto, a sludge was developed quite distinct in properties and color from the sludge which formed in the main tanks. It was well nigh ideal in that it met the conditions recommended in a biography on activated sludge, namely, it was golden brown in color, gave a clear sparkling effluent and was stable for a period of time.

A litre of sludge from the main tanks settled in one hour to about 20 solids and gave a clear supernatant liquid but after 4 to 8 hours rose to the surface due to gas formation. A sample of the same sludge activated in the iron tank settled more rapidly than the former sludge gave a clearer supernatant liquid and remained at the bottom for over a month. At the end of that time it gave no indication of rising.

Immediately the presence of iron suggested itself and an analysis showed that the ordinary sludge had 2.0% iron on a dry basis and 6.1% of the ash was iron, while the new sludge was 5.1% iron on dry basis and its ash was 14.9% Fe. Evidently iron was playing an important part of this sludge process.

An analysis of the raw sewage showed only 4 parts per million of iron present. This did not account for all the iron present in the sludge so therefore some iron must have come from the tank. Having in mind all the possible reactions it was very difficult to predict with any certainty how iron became deposited in the sludge. Three possibilities presented themselves, viz., by bacterial action, by chemical precipitation, and lastly, by small pieces of rust catching in the sludge.

A search of the literature on iron bacteria gave very little encouragement. Biologists still disagree on the theory that some bacteria deposit iron. An iron deposit is found on the sheath of this bacterium, but whether iron is absolutely essential to the life of this organism is not positively known. The best references found were in a work by Harder, and the following extracts have been taken from his publication:

Work of Harder.

1. Harder[1] concludes that according to present knowledge there are three principal groups of iron depositing bacteria. Those that precipitate $Fe(OH)_3$ from solution of ferrous bicarbonate, using the CO_2 set free and the available energy of the reaction for their life processes.

Those that do not require $Fe\ CO_3$ for their vital processes but do cause the deposition of $Fe(OH)_3$ when either inorganic or organic salts are present.

Those that attack iron salts of organic acids using the organic acid radical as food leaving $Fe(OH)_3$ or basic ferric salts that gradually change to $Fe(OH)_3$.

Bacillus $M._7$ was discovered by Mrs. Mumford*[2] during an examination of iron bearing colliery waters in England. It consisted of $Fe(OH)_3$ of fine granular texture with some scattered threads of higher iron bacteria. After various inoculations of this granular material in culture media a bacillus was isolated which produced an enzyme that had the power of precipitating $Fe(OH)_3$ from either ferrous or ferric solutions. Mrs. Mumford states that she succeeded in isolating the enzyme from the organism by filtration.

Crenothrix, the largest of iron bacteria can live in a water which has less than two parts of iron per million. Leptothrix is a simple thread form whose sheaths are a yellowish brown $Fe(OH)_3$.

Theories of Iron Deposition by Bacteria.

Several explanations have been offered for the deposition of $Fe(OH)_3$ by iron bacteria. Some investigators believe that the precipitation is merely a chemical process in no way connected with the internal activity of the cell. Whereas, others claim that the process is one of oxidation of ferrous to ferric compounds and that it is necessary for the life processes of the organisms. Among the first to study the activities of iron depositing thread bacteria were Cohn and Zopf[3]. Cohn believed that $Fe(OH)_3$ was deposited as a result of the activity of the living cells and that a deposition occurred in the same manner as the deposition of silica takes place in the tests of diatoms. Zopf[4], some years later stated that he found $Fe(OH)_3$ being deposited on empty sheaths from which all living cells had been removed. He was of the opinion, therefore, that the storing up of $Fe(OH)_3$ in the sheaths was merely the result of mechanical processes, the iron compounds being taken up by a mucilaginous coating on the sheaths. Later, Winogradsky[5] investigated the physiology of iron bacteria. Experiments were conducted with leptothrix and in the publication of his results in 1888, he states that leptothrix will live and grow only in solutions in which iron is present in the ferrous form and that only where living cells are present in a sheath is there any coloration of the sheath due to oxidation of ferrous salts. He also found that the sheaths did not take up mechanically any $Fe(OH)_3$ that may be present in the solution and believed that the coloration is due to $Fe(OH)_3$ being given off by the cells and caught in the sheath which encloses them. He concludes from this that the oxidation of ferrous compounds to form $Fe(OH)_3$ is necessary for the life and the growth of the organisms and that this process furnishes energy to the cell for the assimilation of food which consists of organic compounds of which he found only a small amount was necessary. He worked with solutions of ferrous carbonate.

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*Can. Engineer 28, P. 336 states that these experiments were conducted by Mr. E. M. Mumford. Mr. F. A. Dallyn, C.E., M.E.I.C., Director of the Sanitary Engineering Division, Toronto, states this is an error, and authorizes quoting Mrs. Mumford.

Molisch[6] in a series of experiments proved that leptothrix will grow profusely in an iron free medium forming perfectly colorless sheaths. If iron or manganese were present he found they were oxidized and taken up by the sheaths. He likewise found that iron or manganese present in the solution causes longer and thicker threads and that sheaths containing live cells accumulate $Fe(OH)_3$ more abundantly. However, threads in which the cells have been killed by boiling in water are still capable of taking up $Fe(OH)_3$ in their sheaths. He determined further that where there was little chance of oxidation a ferrous compound would accumulate in the sheath and cause the same luxuriant growth as $Fe(OH)_3$. He concludes that these organisms show a marked physicochemical attraction for iron and manganese compounds and that the change from ferrous to ferric compounds is due to simple oxidation and is not connected with the life processes of the cells as Winogradsky claimed. He claims that the living cells probably have some influence in keeping the sheaths in a condition in which it can accumulate $Fe(OH)_3$ more easily than the empty ones.

Ellis[7] in 1907 set forth his belief that the deposition of $Fe(OH)_3$ around bacterial threads is purely mechanical. He believes that Winogradsky had no solid basis for his conclusions and thinks with Zopf that the accumulation is the result of the catching up of particles of $Fe(OH)_3$ present in the water by a mucilaginous covering which surrounds the sheath. The presence of such a sheath was demonstrated by Zopf in 1878. Ellis like Winogradsky, worked principally with leptothrix but also examined other cultures, but believes that what is true of leptothrix is true of all iron bacteria.

Lieske[8] in 1911 experimented with spirophyllum, a culture with which Ellis also worked. He finds this organism will grow only in solution containing $Fe\ CO_3$ and that other ferrous salts will not take the place of $Fe\ CO_3$. He finds that much organic matter may completely stop the growth of spirophyllum but that where abundant CO_2 is present in water and organic matter is entirely absent this organism will grow profusely. He claims that the carbonate radical furnishes food for the spirophyllum and that the latter oxidizes the $Fe\ CO_3$ to $Fe(OH)_3$ mainly for the purposes of obtaining carbon. Like Winogradsky, he believes that the oxidation may furnish energy to the organism for the assimilation of food which in this case is CO_2. Mrs. Mumford in 1913 states that Bacillus M.^{7} forms a precipitate of $Fe(OH)_3$ in ferric as well as ferrous solutions. Organic compounds were used as a source of food. $Fe(OH)_3$ was precipitated only under aerobic conditions, and under anaerobic conditions the hydroxide was somewhat dehydrated. She ascribes these reactions to an enzyme which she states she succeeded in isolating from the organism by filtration. The observations of Mrs. Mumford are open to doubt because she did not use control cultures, and the possibility of chemical oxidation taking place in the ferrous solutions has not been eliminated.

After failure to identify any of these iron organisms by microscopic examination a thorough search was made through the literature to see if iron had played any role in the activated sludge process. Several references[9] were discovered where chemists had found from 9 to 18, iron in sludge on dry basis. Most encouraging of all were some publications by G. J. Fowler from his laboratory at Manchester. An extract from Can. Eng. 28, p. 336, is as follows:—

"An interesting development is that described by Dr. Gilbert Fowler and Mrs. Mumford of Manchester. They found that by innoculating a tank effluent with an organism M_7 and adding a small dose of ferric salt—1 grain per gallon—blowing air through for 6 hours and allowing to stand for 6 hours for precipitation, a very clear liquor could be obtained. This organism is found in nature in waters impregnated with iron and once its growth is established there does not appear to be any difficulty in maintaining it." Again in Can. Eng. 30, p. 228. "It would appear that the activated sludge process consists broadly of three operations—a clotting or clarifying action, a rapid carbon oxidation and finally nitrification. It is probably to some extent the result of the activity similar in character to the M_7 organism which was definitely shown to depend on enzymic action whereby traces of iron appeared to start floccation of the whole sewage. The M_7 bacillus is fairly ubiquitous as it has been found that sewage containing iron and a certain amount of activated sludge, but in which clarification has not been effected, can be made to clarify at once by a small quantity of properly activated sludge."

Owing to the claim that M_7 was fairly ubiquitous it was concluded that this organism must be present and a small sample of effluent was treated with a little ferrous sulphate and aerated in a tall glass cylinder fitted at the base with filtros. Iron was precipitated and a clear effluent obtained. Microscopic examination again failed to reveal an organism to which this peculiarity could be attributed.

The presence of M_7 was doubtful and in order to determine if M_7 were responsible a quantity of sewage was boiled for 1 hour, some iron salt added and aeration begun. It was the expectation that there would be no deposit of iron, but the same result was obtained as with unsterilized sewage. Apparently some factor other than M_7 was present.

Chemical precipitation seemed to be the only explanation. It has been proved that in the activation process much ammonia is evolved, which would naturally make sewage alkaline. Then, there are other sources by which alkali gets into the sewage. Tests of the plant effluent showed an alkalinity as high as 200 p.p.m.

Iron Precipitated by Alkaline Sewage.

In order to see if chemical precipitation of the iron in Toronto sewage were connected with the alkalinity, three tall cylinders fitted with filtros were filled as follows and aerated:—

No. 1—300 cc. Distilled Water.	No. 2—300 cc. Boiled Effluent	No. 3—300 cc. Effluent made just acid with—
0.5g of $FeSO_4 \cdot 7H_2O$	0.5g of $FeSO_4\ 7H_2O$	H_2SO_4+0.5g of $FeSO_4 \cdot 7H_2O$

These were aerated 4 hours.

No. 1 showed no change.

No. 3 showed no change, i.e., no precipitate.

No. 2 turned brown very rapidly and a precipitate came in a few seconds—quite a heavy precipitate in 4 hours.

In order to demonstrate the formation of the flock in the presence of iron the following experiment was performed.

2,500 cc of sewage containing 4 p.p.m. iron and of 150 p.p.m. alkalinity were aerated 16 hours in a tall glass cylinder fitted with filtros. At the same time a 300 cc sample of this sewage was aerated after 0.5 g. $Fe\ SO_4\ 7H_2O$ was added. At the end of 15 hours the large tube had a small grey flock, but the small one had a large golden brown one.

There remained one way yet in which it could be decided whether bacteria or chemical precipitation was responsible for the iron deposition in Toronto sewage. A sample of sludge was washed 6 times with tap water to free it from any alkaline solution. It was then washed with distilled water and dried on a Buchner filter. The sample was put in 1 litre of water and was well shaken. It was neutral to litmus. By this means a large amount of bacteria were introduced. A 300 cc sample of this together with 0.5 g. of $Fe\ SO_4\ 7H_2O$ was aerated for 12 hours with no change apparent in the flock. When a few cubic centimetres of alkali solution were added a brown color was imparted to the sludge in a short time.

The next step was to find the effect of sewage on iron itself during aeration. Four 5 litre tubes fitted with filtros were treated as follows:—

	TUBE 1	TUBE 2	TUBE 3	TUBE 4
Amount raw Sewage	4 L.	4 L.	4 L. Boiled Sewage	4 L. Boiled Sewage
Iron Present....	5 strands clean soft iron wire no trace of rust.	None	5 strands clean soft iron wire free from rust.	None
Time of aeration 2 Hours.	Quite Brown, Distinct Flock.	Very Little Change.	Distinct Brown Flock.	Very Little Change.
3 Hours	Brown Colour more Pronounced.	Very Little Change.	More Brown Flock.	Very Little Change.
Estimation of Iron in Flock after 4 Hours.	35 p.p.m.	8 p.p.m.	15 p.p.m.	8 p.p.m.
24 Hours.......	35 p.p.m.		46 p.p.m.	
72 Hours.......	63 p.p.m.		60 p.p.m.	

The wide variation in figures may be due to the fact that it was hard to get a uniform sample of the flock.

Autoclaved sewage aerated in the presence of iron wire behaved the same as raw unsterile sewage. A 300 cc sample of autoclaved sewage (at 18 lbs. for 35 min.) when aerated in the presence of a clean sterile coiled iron wire became brown in color in 15 minutes. In 1½ hours there was sufficient flock to settle rapidly. This flock when examined microscopically gave no evidence of bacteria present.

That the presence of iron characterizes the color of the flock, aids in clarification, rapid settling and in keeping down the flock is shown by the data in the following series of experiments. (See tables III. and IV.)

Settling Rapidity—3 and 4, fast and clear; 2, rapid but not so clear; 2, 3 and 4, more rapid than No. 1; No. 6, more rapid and clearer than No. 5. The sludge varied in color from yellowish brown to dark brown, depending on the iron present.

The presence of iron apparently increased the total nitrogen in the sludge. A large sample of sludge aerated for 3 days gave total nitrogen on a dry basis 4.2%, 4.6%, 4.8% on each of the three days. Iron was added to this and aeration continued for 3 days. The total nitrogen then was 5%, 5.5%, 5.7% at the end of each day.

The moisture content of the sludge was not changed by the presence of iron. Samples of ordinary and iron sludge were centrifuged and both ran from 91-92% moisture. The rate of evaporation from equal amounts of ordinary and iron sludge in dishes of the same size at a temperature of 110° C was determined and gave but little difference. For a period extending 2½ hours the rate of the ordinary sludge was 0.160 g. of water per minute, while that of the iron sludge 0.165 per minute.

Finally it was deemed advisable to analyse sludges from different activated sludge plants in the United States. Samples of dried sludge were obtained and the following table gives the result of the analyses:—

Color varies with per cent. of iron from grey black to chocolate brown. Worcester reddish brown.

In the table No. IV. it would hardly be fair to use the total nitrogen figures for comparison for they would depend a great deal on the drying and age of the dry sludge.

General Conclusions.

As a result of this investigation it is quite evident that iron plays a very important role in the activated sludge process and the difference in iron content explains the difference in color, flocking and settling of the various sludges which are formed in activated sludge plants.

Attention is also drawn to the M_r organism and question is raised as to the necessity of its presence to begin floccation of iron since the sewage itself is alkaline and thus forms the hydrate. Finally, it is worthy of note that iron pipes are very readily oxidized by the alkaline sewage in the presence of oxygen.

TABLE III.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Amount of Sewage and Sludge...	5 Litres	5 Litres	5 Litres	5 Litres	2,700 Gal.	2,700 Gal.
State..............................	Raw and Partly act'd	Raw and Partly act'd	Raw and Partly act'd	Raw and Partly act'd	Raw and Partly act'd	Raw and Partly act'd
Iron Present......................	None	$5g FeSO_4 . 7H_2O$	$2.5g FeSO_4 . 7H_2O$	Iron Wire Coil	None	18 lbs. $FeSO_4 . 7H_2O$
Time of Activation............	4 Hours	4 Hours	4 Hours	4 Hours	3 Days	3 Days
Time Elapsing Before Rising after Settling.....................	4 Hours	24 Hours	24 Hours	23 Hours	5 Hours	Circ 7 Days
Effluent	Effluent Like 5	Slightly Yellowish Effluent	Clear Effluent	Clear Effluent	Small Particles Floating	Clear Effluent

TABLE IV.

	Houston	Toronto	Urbana	Milwaukee	Cleveland (1)	Cleveland (2)	Worcester
Dry Basis % Fe...............	1.1%	1 65–2 0	2.3	4.8	13.36	17.29	19.04
% N........................	4.3	3.3	4.18	4.31	3.2	5.7	3.0
Non Volatile.................	35.3%	50 2%	40%	46.4%	56.0%	8%	38.6%
Volatile......................	64 7%	49.8%	60%	53.6%	44.0%	51.2%	61.4%
Iron p.p.m. of Sewage..........	No Data	4 p.p.m.	No Data	10–100 p.p.m.	O——	—300 p.p.m.	No Data

The author desires to express his thanks to Mr. F. A. Dallyn, Director of the Sanitary Engineering Division, Toronto, and to Mr. A. V. Delaporte, chemist in charge of the Experimental Station, under whose personal supervision this investigation was conducted.

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Chemical Society News

"PROFESSIONAL" ENGINEERS MUST WAIT.

It took the Ontario Government the most of one afternoon to send back the bill relating to Professional Engineers, brought in by A. W. Grey (Cons.) of Leeds, for further study by a special committee.

Supporters and opponents were developed in all parties. Some of the opposition was not overly well thought out or particularly strong, perhaps far-fetched. The difficulties of wording an act to include so many fields was very much in evidence. Compulsory registration was considered objectionable by the Chief Speaker for the Government. He felt that unqualified men should not pose as engineers; but failed to admit the necessity for any organization compelling membership. The Conservative Leader wished to alter the penalties and moved to that effect, but later withdrew his motion. There was some objection to the exceptions of the bill, which were designed to allow private construction on mining property up to $5,000 without professional engineering assistance.

Mr. Z. Mageau, Liberal member for Sturgeon Falls, seemed particularly adverse to the bill, as he thought it would interfere with construction of sawmills and prohibit the employment of millwrights, thereby working a hardship. There was also grave fear expressed that some of the "practical" engineers might be injured, although there are requirements taking in all qualified men of experience. There was also some talk of "close corporation" among farmer representatives.

Most of the criticism was of a rather mild type, everything considered, and the Committee should be able to satisfy all members by adjustments which will not destroy the aims and objects of the legislation.

HONORARY DEGREES CONFERRED AT QUEEN'S.

At the Convocation at Queen's University, Kingston, Ont., on May 10th, the degree of LL.D. was conferred upon Professor S. F. Kirkpatrick, M.Sc., formerly Professor of Metallurgy at Queen's and now adviser for the firm of M. J. O'Brien, Limited, and also on Dr. Charles Camsell, Deputy Minister of Mines, Ottawa.

TORONTO SECTION, SOCIETY OF CHEMICAL INDUSTRY.

Dr. Bruce Macallum, of the Synthetic Drug Co., Toronto, was the speaker of the evening at the last meeting for the session, 1921-22, of the Toronto Section, Society of Chemical Industry. The meeting was in charge of the Toronto members of the Canadian Institute of Chemistry, and, in the absence of Mr. M. L. Davies, Chairman of the Section, Professor J. Watson Bain, President of the Institute, presided.

The subject of Dr. Macallum's address was "Vitamines." The speaker himself has carried out a considerable amount of research work on the subject, and gave a most comprehensive review of work done in all fields. His lecture was illustrated. He traced the investigations from their beginnings in a study of Eastern malnutrition diseases, through the early efforts to isolate active fractions, and determine the chemical nature of the active substances. He developed the functions of various classes of vitamines, A, B and C, and considered at length means of determining their presence by feeding experiments and yeast cells. Their function in specialized diets was illustrated by growth curves of rats and the curative properties, illustrated by means of pigeons and rats in various stages of neurities. Vitamins in plants was touched upon.

The whole lecture was a most complete summary of the subject to date. Further research is required, and in order to determine exact nature of the substances and synthesize them, some very large scale experiments may be necessary. Some reference was made to the attempt on the part of some companies to advertize vitamine foods and pills. Nature in fresh fruits and milk provides a much better supply, if judgment is shown in selecting the diet.

Dr. Lash Miller, in complimenting the speaker, referred to some research work on yeast that was being carried on in his laboratory, pointing out that the new knowledge explained more readily the active growing of yeast cells under certain conditions.

Three new members were elected to the local committee of the Society of Chemical Industry—Messrs. Bain, Schorman, and V. van der Linde.

LONDON CHEMISTS AND MANUFACTURERS GETTING TOGETHER.

A number of meetings of leading manufacturers in London, Ont., and chemists, have been held recently. Mr. D. H. McDermid has been mainly instrumental in bringing this about through the Chamber of Commerce. A "Science in Industry" committee was formed and meetings held covering the following subjects:

1. Chemistry Applied to Iron and Steel Industry.
2. How to Get the Best Value from Coal.
3. The Problem of City Water.
4. Cellulose Acetate.
5. The Manufacture of Iron and Steel.
6. The Application of Physics in Industry.

The value of science to industry is being fully demonstrated in these lectures and discussions. The activities of the Western University are being linked up with the industries of the City by this means. As a net result, the business men of the city are appreciating more than before the place of research and scientific control in industrial work.

This series of meetings is doing considerable for Chemistry and Chemical Engineering in London, and the idea could be carried out with good results in many other Canadian cities and towns. Among the members of the Society of Chemical Industry in London who are active in this work are Mr. A. Burton and Mr. T. A. Faust.

SHAWINIGAN SECTION HEARS ADDRESS ON STEEL MANUFACTURE.

The Shawinigan Falls Section of the Society of Chemical Industry held a meeting on Wednesday, April 26th, in the Technical School, which was largely attended by the men of the local industries.

Mr. W. G. Dauncey, of the Shawinigan Foundries, gave a very interesting talk on "Steel, Its Manufacture and Treatment."

After briefly describing the manufacture of pig iron, Mr. Dauncey discussed the various processes by which it is turned into steel and described the properties of the different products, illustrating the apparatus used and also the micro-struction of the products by a number of slides.

He also described some experiments in casting rolling ingots in special molds to minimize the "pipe" effect.

The interest of the audience was shown in the lively discussion which followed.

NEW MEMBERS OF CANADIAN INSTITUTE.

The following have been elected to membership in the Canadian Institute of Chemistry:

Fellows (F.C.I.C.).

Jasper Henry Hume Nicolls, B.Sc., M.Sc., Fuel Testing plant, Booth Street, Ottawa.

Robert J. Trail, Mines Branch, Division of Ore Dressing, 552 Booth Street, Ottawa.

Ernest A. Smith, B.A., M.A., Standard Chemical Co., Limited, 524 St. Ambroise St., Montreal, Que.

Alonzo John Klock, 559 Parkdale Ave., Ottawa.

H. C. Maybee, Mines Branch, 552 Booth St., Ottawa.

Associates (A.C.I.C.).

William Lloyd Linton, Phm.B., 297 St. Claren's Ave., Toronto, Ont.

AMERICAN ELECTRO-CHEMICAL SOCIETY NEW OFFICERS, 1922-23.

President—C. G. Schluederberg, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Past President—Acheson Smith, Acheson Graphite Co., Niagara Falls, N.Y.

Vice-Presidents—H. C. Parmelee, Editor of Chem. & Met. Engineering, New York City; A. H. Hooker, Hooker Electro-chemical Co., Niagara Falls, N.Y.; W. S. Landis, American Cyanamid Co., New York City.

Managers—A. T. Hinckley, National Carbon Co., Niagara Falls, N.Y.; W. M. Corse, National Research Council, Washington, D.C.; Wm. Blum, Bureau of Standards, Washington, D.C., together with the following of last year's Executive: H. B. Coho, F. J. Tone, C. Hering, J. V. Dorr, and F. A. J. Fitzgerald.

Treasurer—F. A. Lidbury, Oldbury Electro-chemical Co., Niagara Falls, N.Y.

Secretary—Colin G. Fink, Consulting Electro-Metallurgist, 101 Park Ave., New York City.

Bradley Stoughton, Consulting Engineer, New York, was elected Chairman of the Electrothermic Division.

Arthur W. Carlyle, B.Sc., of Ottawa, has been appointed Leroy Fellow in Geology at McGill University for 1922-23.

OIL CHEMISTS MEET AT NEW ORLEANS.

The American Oil Chemists' Society held their 13th annual meeting at New Orleans on June 5th and 6th, 1922. The program included addresses by Dr. L. M. Tolman, Chief Chemist, Wilson & Company; Dr. J. H. Shrader, Director of the Baltimore Municipal Laboratory; Dr. David Wesson, Technical Director, The Southern Cotton Oil Company; Dr. W. D. Richardson, Chief Chemist, Swift & Company; Dr. Geo. S. Jamieson, Chemist in Charge, Oil, Fat and Wax Laboratory, U.S. Bureau of Chemistry; Mr. C. B. Cluff, Superintendent of Manufacturing Department, The American Cotton Oil Company, who is President of the Society, and Herbert Bailey, Chief Chemist, The Southern Cotton Oil Company, and Editor of the Chemists' Section of the Cotton Oil Press.

CONFERENCE ON NON-FERROUS ALLOYS.

At a conference of the Advisory Committee on Non-Ferrous Alloys of the Institute of Metals Division of the American Mining and Metallurgical Engineers and representatives of the United States Bureau of Mines, held on April 25th last, the question of the functions and development of the proposed Alloys Research Association, known as the Alloys Research Information Service, was discussed. A fund of $40,000 would be required for this work and the original idea was to receive contributions of $250 each from firms in the non-ferrous metal industry. The work would begin as an information and abstracting service and later develop into a central research laboratory. It was decided that, owing to the depressed industrial situation, no action would be taken, but companies have signified their willingness to co-operate when business conditions improve.

IMPORTANT DISCOVERIES IN RESEARCH ON DIABETES.

Dr. F. G. Banting, of the Physiological Department of the University of Toronto, assuming that the digestive ferments were agents in destroying the anti-diabetic principle of the pancreas, has been able to secure extractives of a curative nature by first causing degeneration of the ferment. Results to date are most favorable, and general relief, if not cure, in several cases, has been established. Intensive work is now going forward to prepare the extract in bulk, identify its nature, and, if possible, produce the substance synthetically.

NEW AIMS FOR CEMENT CONSTRUCTION.

On April 27th, Lieut.-Col. H. C. Boyden, who is associated with Prof. D. A. Abrahams, of the Lewis Institute, Chicago, lectured before the Engineering Institute of Canada at Montreal, in "Recent Developments in Concrete." The Lewis Institute has been working since 1914 for the Portland Cement Association, carrying on exhaustive tests. One remarkable statement by the speaker was that, during 1921, cement construction in the United States amounted to $1,000,000,000, at least, and that the value of the work might have been increased from 25% to 33%, if the work had been done in the best known scientific manner. He stressed the important place of water and clear sand in securing strength, and pointed out that practice and theory can be made the same if proper care is taken. The Canada Cement Co., a member of the Association, constructed a $2,000,000 structure at Montreal, where the average variation from the desired result was never more than 1 3/10%.

NEW BOOKS

"THE CHEMISTRY OF THE NON-BENZENOID HYDROCARBONS."

By B. T. Brooks. Chemical Catalog Co., New York. 600 pp. Price, $7.00 (American).

This book should do much to place the subject with which it deals before industrial chemists and teachers of organic chemistry in a more concrete organized way than ever before. It has that inherently stimulating and research-suggesting quality which marks out the author, who is a leader in the field, from one who just gathers information.

The author has no need to apologize to the petroleum or other industries, whose raw materials are in this general class of organic substances. It is well recognized on all sides that the study of the chemistry and chemical mechanism of the reactions possible within this group have hardly kept full pace in America, and can certainly be pushed further with great advantage. The petroleum, rubber, turpentine and essential oil industries stand in need of further systematic, theoretical research in this field of chemistry.

The book sets forth the principal accomplishments to date in fundamental work done on the products used in the above industries, and places in systematic order the chemistry of practically all the major hydrocarbons within its scope.

The general plan of the work presents the material in the following order: Paraffins, Chemical properties of saturated hydrocarbons, Paraffins hydrocarbons, an excellent chapter on the ethylene bond, acyclic unsaturated hydrocarbons; polymerization, several classes of cyclic and bicyclic non-benzenoid hydrocarbons, rearrangements and physical properties.

The work is indeed a monograph worth while in the broadest sense.

"MODERN CHEMISTRY, PURE AND APPLIED."

By A. J. Hale. Vol. IV. 280 pp. Virtue & Co., London, and Westman Press, Ltd., Toronto. Price, $4.50.

Volume IV. covers the compounds of carbon, principally giving the chemistry of the subject after the general plan of organic texts, adding much industrial information, wherever there is an industry or a business based on the reactions involved. The book is suitable for reference, and for a first reading of the subject, as the data is given with a considerable amount of explanatory reading matter and discussion. This Volume maintains the industrial viewpoint of others in the series, and in this way differs from most organic texts. The work should fit the requirements of both student and industrial chemist, as a good general survey of organic chemical industries, viewed in the light of their most recent developments. It supplements previous volumes of the series reviewed in this paper.

"RAYS OF POSITIVE ELECTRICITY AND THEIR APPLICATION TO CHEMICAL ANALYSIS"

By Sir J. J. Thomson

Longmans, Green & Co. 235 pages. Price $5.25.

Further fundamental scientific work on the structure of the atom and the molecule is likely to make more rapid progress in the near future than was possible during the war. This second edition contains both new matter and plates. The authors pay considerable attention to the Properties of Positive Rays. Although the title includes the Application to Chemical Analyses, it is frankly admitted that the present situation is but the beginning of the harvest of results that will eventually lead to new general conceptions on the mechanism of all types of chemical reactions.

This book is a very compact and concise statement, discussing present knowledge and the experimental data upon which it is based.

"A SYSTEM OF QUALITATIVE CHEMICAL ANALYSIS"

By. G. W. Sears

John Wiley & Sons, New York. 120 pages

The work covered is outlined under three heads. Part 1—Introduction: A discussion of Ionic Theory and Mass Action; Part 2—Metal Ions; Part 3—Acids.

The idea in the method of presentation is to give the student a comparative review of the actions of the different metal ions in a group toward a given reagent, and, in the case of an ion analysis, the method given follows in general the procedure for metals, using mainly precipitations.

"GAS CHEMISTS' HANDBOOK"

American Gas Association, New York. 586 pages

A most excellent specialized book for chemists. Some of the leading men in gas works practice have contributed to make this publication of the Association a standard work. The subject matter is divided as follows:—1. Raw Materials; 2. Products of Gas Manufacture; 3. Impurities in Gas; 4. Miscellaneous Materials. A good set of practical tables is given. This is one of the books that can be recommended without hesitation to all chemists interested in the field. It is written by men of experience for practical work of the most approved scientific nature.

"THE VITAMINS"

By H. C. Sherman and S. L. Smith

Chemical Catalog Co., New York. 270 pages. Price $4.00, New York

The subject discussed has now been brought to the point where a book literature is both necessary and possible. The work of these authors in gathering their material and thoroughly digesting it shows great attention to detail. A very clear sense of values and keen judgment.

In general, the three recognized vitamins or classes of vitamines A. B. and C., are treated separately. The research work connected with our knowledge of them is outlined and methods of measurement discussed. Following each, a most important summary of properties is given. Most common foods have been studied and their relative values, from a vitamine standpoint, are tabulated.

This book will give readers whose minds have been confused on the subject a clear interpretation of the full significance of the results of scientific studies of "deficiency diseases," and should go far to assist in the practical application of these new conceptions in the choice of adequately balanced diets. The book is within the reading power of anyone and yet the trained investigator will find many unsolved problems brought to his attention. For example, the pure chemistry of the subject is still mostly for the future.

REPORTS RECEIVED.

Lead, 1913-1919.—Report of Mineral Industry of British Empire and Foreign Countries. H. M. Stationery Office, London, Eng. Similar reports on Tin and Metals of the Platinum Group are now available also.

World Conditions and News in Chemical Fields

(Special Correspondence to Canadian Chemistry and Metallurgy by our London Representative)

Effect of Safeguarding of Industries Act on Prices.

Business for home trade continues very quiet, and orders for export are also on a small scale. The little extra demand for certain chemicals noticed some weeks ago has practically disappeared.

In view of certain criticisms of the effect on prices of the Safeguarding of Industries Act, it is of interest to give, in the following schedule, a dozen chemicals which are entirely or chiefly manufactured in this country, and the same number of chemicals which are solely or largely imported.

No attempt has been made to select unusual examples, the only considerations guiding the selection being the importance of the product and the readiness with which statistics are available for providing accurate and comparative quotations.

Chemicals (British)	Value Oct. 1	Value April 1
Acetone	85/0 cwt.	75/0 cwt.
Aspirin	3/2 lb.	2/10 lb.
Benzoic acid	2/4 lb.	1/6 lb.
Beta Naphthol	3/6 lb.	2/6 lb.
Calcium Lactate	2/6 lb.	2/0 lb.
Formaldehyde	95/0 cwt.	74/0 cwt.
Formic Acid	65/0 cwt.	60/0 cwt
Methyl Salicylate	2/9 lb.	2/4 lb
Salicylic Acid	1/6 lb.	1/4 lb.
Sodium Hyposulphite	25/0 cwt.	19/6 cwt.
Salol	2/8 lb.	2/0 lb.

Chemicals (Imported)	Value Oct. 1	Value April 1
Amidopyrin	21/0 lb	18/0 lb.
Barbitone	12/0 lb.	11/0 lb.
Chloral Hydrate	5/6 lb	5/0 lb.
Guaiacol Carbonate	12/6 lb	9/6 lb.
Hexamine	4/3 lb	3/0 lb.
Lithium Carbonate	12/0 lb	10/6 lb
Paraldehyde	2/0 lb	1/1 lb
Phenacetine	6/6 lb	5/3 lb
Phenazone	8/0 lb.	7/6 lb.
Phenolphthalein	4/6 lb	3/3 lb.
Potassium Permanganate	1/0 lb	– 9 lb.
Resorin	8/3 lb	7/3 lb.

In order to arrive at a definite ratio of values it is convenient to consider each item as a unit and total the four columns. Thus treated, the British chemicals show values of £14 10s. 10d. (in October) and £12 5s (in April), and the imported chemicals £4 17s. 6d. (in October) and £4 2s. 4d. (in April). By coincidence the percentage of difference is almost identical, and the average decrease in value of all the chemicals included is over 15 per cent. In other words, the Act has not led to a general increase in price to the consumer of either British or foreign chemicals, despite the 33 1-3 per cent. duty and the prophecies to the contrary.

Rustless Iron.

Arising out of the development of stainless steel is a more recent one of equal importance—that of rustless iron. It is in a comparatively early stage yet, but it promises to cover a wide field of usefulness. Being more ductile than steel, it can be worked up into an endless variety of articles, and the makers are confident that it will quickly replace brass, copper, gunmetal, white metals and ordinary iron and steel for a multitude of parts and fittings. A later innovation consists of a non-ferrous alloy to replace plated nickel silver in the manufacture of spoons, forks, table hollow ware, and cooking vessels, and also of machinery parts which are liable to corrode. While not entirely untarnishable, it resists the action of the atmosphere, of acids, alkali, and water to a very remarkable extent, and with little or no cleaning preserves its excellent, silverlike color for a long time. Compared with plated nickel silver, it is very cheap, and it is also extremely durable.

German Iron Industry Meets Strong Competition.

The German iron industry is carrying on a hard struggle with foreign manufacturers on foreign markets. Profits on export transactions are growing smaller and smaller, as foreign countries are gradually reducing their costs of production. The recent increases in wages in the German coal trade entail higher wages in the iron industry, and in consequence prices of finished goods are likely to rise above would-market quotations, unless such a result is averted by a further fall in the mark.

The following instances show to what extent the German metallurgical industry has lost its power to compete on the world's markets.

Belgium quotations for steel rims for the Spanish market were 3 per cent. below German prices, while Belgian quotations for similar goods for Scandinavia were 6 per cent. below. Great Britain quoted prices 10s. lower than German offers of heavy plates for the British colonies. Large South American and Dutch orders for steel rails have gone to Belgium. German industry might have obtained some of this business were it not for the export duties, which have to be added to the charges. In fact it is complained that Lorraine and Luxemburg concerns are underbidding German firms in the domestic market, to which they have access duty free.

Reparation Dyes and General Trade With Germany.

Mr. Hilton Young, replying to a question in the British House of Commons, said the total weight of dyestuffs received by Great Britain from Germany by way of reparation up to December 31 last was 4,070 tons, in respect of which approximately £570,000 (or £140 a ton) was credited to Germany. Two thousand four hundred tons have been sold for approximately £381,000, after the deduction of expenses of realization (or £228 a ton), which, therefore, represents the value ruling at the dates of sale. Mr. Baldwin, in a statement showing the trade of the United Kingdom with Germany by values in 1920 and 1921, quotes the following figures:

	1920.	1921.
Imports from Germany	£30,252,000	£20,550,000
Exports to Germany:—		
U.K. produce and manufacture	21,707,000	17,831,000
Foreign and Colonial produce and manufacture	29,382,000	22,897,000

The figures for 1920 include and those for 1921 exclude trade with Memel, Danzig, the part of Poland formerly German, part of Slevig (now Danish), and Luxemberg. The imports of Luxemburg into the United Kingdom during 1921 amounted to £629,365, exports to Luxemburg of United Kingdom produce to £8,398, and exports of foreign and colonial merchandise to £1,341.

Spain Ranks Second in World Copper Production.

Some interesting details concerning the Spanish metal industry are furnished by the American Commercial Attache at Madrid. Spain is reported as being the second country in the world in the production of copper, 90 per cent. of her output being controlled by British interests, the majority of the production coming from the Rio Tinto mines, which are developed by foreign capital. In 1919 the production amounted to 864,414 tons, valued at 13,387,261 pesetas. Spain is also second in the production of lead, and in 1919 produced 136,180 tons of lead ore, valued at 46,129,647 pesetas, and 41,875 tons of silver-bearing lead, valued at 10,259,351 pesetas. French capital controls all the Penarroya lead industry. In the production of mercury Spain leads all countries, having in 1919 produced 24,966 tons, valued at 6,356,435 pesetas, all of the quicksilver being exported under contract with the Rothschilds. The output of iron ore for 1919 was 4,640,061 tons, valued at 45,418,344 pesetas, and there were also produced 431,189 tons of iron pyrites, valued at 5,139,423 pesetas. The iron ore industry, however, is capable of much greater development.

Czecho-Slovakia's Steel Industry as Advanced as Germany's.

Up to the present not much notice has been taken of the fact that Czecho-Slovakia has an iron and steel industry as advanced as that of Germany. Iron ore exists in large quantities in Slovakia and in the neighborhood of Kladno, and there are also smaller deposits in other parts of the country.

The iron and steel industry is centred in the coal districts, and the engineering industry in the large towns, notably Prague, Pilsen, and Brno (Brunn). There are blast-furnaces, large iron and steel works with rolling mills, steel and iron foundries producing steel castings in all qualities and weights, and also malleable castings, and forges producing forgings for all branches of industry and for shipbuilding.

Before the break-up of Austria-Hungary most of Austria's industry was concentrated in Czecho-Slovakia, and works that are now within the Czecho-Slovakian frontiers supplied half-finished products and machinery to all parts of Austria-Hungary. The Czecho-Slovakians have the same methods and processes as their German competitors, their prices, in the long run, are at least as low, if not lower, and they have the additional advantage that their prices are fixed because conditions there are settled and the exchange rate is stable and the best in Central Europe.

Italian Soap Industry's Notable Development.

The Italian soap industry has developed notably since the war. In 1920 there was an excess of nearly 1,000 tons in the export of common soaps over the imports. On the other hand, the imports of high-grade soaps still exceed the exports, and British manufacturers hold the first place as to quantity.

France to Increase Dyestuff Duties.

The "Journee Industrielle" learns that the Commission for the revision of the coefficients of increase of Customs duties has decided in favor of an eventual increase in the coefficient on dyestuffs from three to six. Dyestuffs not yet manufactured in France, however, would continue to pay the old duties.

Chilean Nitrate Exports Decline.

The exports of nitrate from Chile during last year show a heavy decline when compared with the shipments during 1920, the total being only 1,100,000 metric tons, as against 2,750,000 metric tons. According to the American Commercial Attache at Santiago no change is likely to take place in the present restricted nature of business until there are indications of an increasing consumption of nitrate in European and American markets.

TORONTO OVERSEAS TRADE OFFICES MOVED.

The offices of the H. M. Trade Commissioner at Toronto have been moved from the Confederation Life Bldg. to 24 Adelaide St. West, Toronto.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy)

Mineral Production in B.C., 1921.

Owing to the fact that no preliminary estimate of the mineral production of the Province was issued by the Provincial Department of Mines this year, it has been found possible to get the Annual Report of the Minister of Mines out fully six weeks earlier than usual, and mining men generally throughout the Province think the change a marked advantage. As all the returns were not in when the preliminary estimate has been made, during the first week in the year, there always has been a good deal of guess work in making the estimate, and consequently erroneous figures have been spread broadcast throughout the world.

The following are the official figures of the mineral production of the Province for 1921, those of 1920 being given also for the sake of comparison:

	1920.		1921.	
	Quantity.	Value.	Quantity.	Value.
Gold placer, ounces	11,080	$ 221,600	11,660	$ 233,200
Gold lode, ounces	120,048	2,481,392	135,663	2,804,154
Silver, ounces	3,377,849	3,235,980	2,673,389	1,591,201
Copper, lbs.	44,887,676	7,832,899	39,036,993	4,879,624
Lead, lbs.	39,331,218	2,816,115	41,402,288	1,693,354
Zinc, lbs.	47,208,268	3,077,979	49,419,372	1,952,065
Coal, tons, 2,240 lb....	2,595,125	12,975,625	2,483,995	12,419,975
Coke, tons, 2,240 lb....	67,792	474,544	59,434	416,038
Miscellaneous products..	....	2,426,950	....	2,077,030
		$35,543,084		$28,066,641

The year was one in which the big mining companies were mainly responsible for the production, the smaller concerns being unable to contend against the low prices of base metals and the high cost of labor and supplies. In round figures, the Granby Company was responsible for 90 per cent. of the copper, the Consolidated Company for 90 per cent. of the lead and nearly all the zinc, and the Premier, Consolidated, and Belmont Surf Inlet Companies for 90 per cent of the gold and nearly half of the silver. The bulk of the coal output was produced by half a dozen companies.

Premier Mine's Excellent Showing.

The feature of the year in metalliferous mining was the wonderful showing made by the No. 1, or Northwestern Mineral District, in general, and by the Premier mine, in particular. This district provided 67 per cent. of the total tonnage mined in the Province, and produced 62 per cent. of the gold, 58 per cent. of the silver, and 89 per cent. of the copper. While everyone expected a good account from the Premier mine, the actual production far exceeded the most sanguine expectations. Thanks to the fact that the new tramway was completed on December 31, the company was able to ship, before the end of the year, a large amount of concentrate that had been accumulated at the mine. The Premier Company shipped and treated at its mill, 18,750 tons of ore, which yielded 40,104 ounces of gold and 1,177,978 ounces of silver. At the average price of silver for the year, 62.65 cents, this gives the ore a value of $83.56 per ton, but this must not be taken as the average value of the ore, because a large proportion of the ore was composed of cullings from high-grade ore that had accumulated at the mine since the first shipments were made. This ore was treated at the concentrating-cyanide plant at the mine. It will be noticed that in the ore treated last year the gold content formed about 53 per cent. of the total value, while in all previous years the value of the silver content was considerably the greater.

Big Smelters Have Good Record.

The only other feature of note is the really remarkable showing that was made by the two big smelting companies. That these two concerns were able to continue operations, while similar concerns in the United States were forced to close their plants, would speak well for those responsible for their management, but that they both markedly increased their outputs, compared with those of the previous year, is really a most praiseworthy achievement. As shown by the annual report, recently published, the Consolidated M. and S. Co. operated at a slight profit; the Granby Company's report has not been issued at the time of writing, but, it is understood, it will show an operating loss for the year, but the loss would have been considerably greater had the plant been closed. Besides, it is worth a good deal to keep as good a staff as the Granby Company has accumulated together.

Large Water Power Development For Granby.

The Granby Company has let the contract for the dam for its new reservoir on Falls Creek, a mile and a half above the present reservoir, to Dredging and Contract, Ltd., of Vancouver. The price is in the neighborhood of $350,000, and with the additions that are to be made at the power plant the total cost will be about half a million dollars. The work has been started and, it is expected, the plant will be in operation before the end of the year. To finance the undertaking and at the same time to retire some of its existing bonds, the Granby Company is offering its shareholders 30,000 new shares at $25, the present quotations being about $27. Owing to the fact that it will enable the plant to operate entirely by water power in the future, instead of having to use steam for auxiliary power during from two to five months in the year, it is estimated that the new reservoir will pay for itself within two years, by reducing the cost of copper production. During the month of April the company made a new high record by smelting 91,123 tons of ore.

Notes.

George Wingfield, of Goldfield Consolidated, has entered action against the Taylor Mining Company for the recovery of $200,000, being a loan, with accrued interest, that was made to the old Dolly Varden Mines, Ltd. When by a Provincial act of parliament the Dolly Varden mine was invested in the Taylor Mining Company, this was one of the liabilities of the old company that the Taylor Company was ordered to pay.

Creditors of the National Finance Company having given their approval, Justice Murphy has sanctioned the expenditure of $18,000 on diamond drilling on coal lands on the Skeena River, in which company was interested. The development work is necessary to hold the claims, upon which $300,000 has been expended, and, it is said, fifteen million tons of semi-anthracite coal has been proven. The drilling, it is claimed, should demonstrate the existence of some 300 million tons of coal.

BRITISH COLUMBIA INDUSTRIAL NOTES.

An order for the sale of the Western Canada Pulp Company, formerly the Rainy River Pulp Company, has been made recently by Justice Macdonald. This, it is said, presages the re-organization of the company, whereby the bond holders will take over the property, expend $250,000 on water power and other developments, and restart operations. The shareholders and creditors will have an opportunity to bid on the property, the sale taking place on June 15. Neither shareholders nor creditors are opposing the sale. The application for the order for the sale of the property was made by J. G. Gibson, on behalf of the holders of first mortgage debentures, amounting to $1,000,000 and $105,000 accrued interest. There is no equity left for the shareholders, who hold the second issue of debentures, amounting to $1,200,000, nor for the unsecured creditors, whose claims amount to $552,000. In 1919 the property was sold under a somewhat similar order of the Court and was operated for four months at a loss, it is said, of $100,000. The property consists of a 40-ton pulp mill and timber limits that are valued at $1,100,000.

New Chemical Company Purchases Site.

The Oliver Chemical Company, which consists of the Hon. John Oliver, Premier of British Columbia, and his two sons, has purchased a site at Penticton and will start at once to build a factory for the manufacture of insecticides, under the management of Charles E. Oliver, who is a graduate in chemistry of Toronto University. The company built an experimental plant at Vernon, and the sprays that it manufactured have met with so much favor among the fruit growers of the Okanagan Valley that the larger plant was decided upon. Penticton was chosen as the site because it is equally convenient for the Okanagan Valley and more convenient for the Kettle Valley, which rapidly is becoming a prominent fruit-growing centre.

Shark Skin Tannery Proposed.

It is rumored that capitalists propose to start a sharkskin tannery at some point on Vancouver Island. Sharks' skins are said to be useful for the manufacture of gloves, hand-bags and purses. If the plan goes through, oil, gelatine and fertilizer also would be manufactured. A great number of sharks are found in the waters along the shores of the island.

ALBERTA AND NORTHWEST TERRITORY OIL NOTES

A syndicate which includes Senator N. Currie, of Nova Scotia; W. W. Butler, of the Canadian Car Company; J. W. Norcross, of the Canadian Steamship Lines; General J. W. Stewart, contractor of Vancouver; and R. N. Wolvin, of the British Empire Steel Corporation, has been formed to drill for oil in the Hay River region during the coming summer. The work planned is said to be on a more extensive scale than any yet done in the Great Slave Lake or Athabaska districts.

Owing to the promising oil indications in the Pouce Coupe district, the C.P.R. proposes to continue the Dunraven and British Columbia railway to Pouce Coupe. The Imperial Oil Co. is sinking four bore-holes at this point and other companies have stated their intention to drill this summer if the necessary outfits can be taken to the properties.

News from Fort Norman.

Jurio Wada, the little Japanese "musher," who has been "mushing" in the Yukon, Northwest Territory, and Alaska for many years, has just returned from Fort Norman, where he has been for Vancouver capitalists for whom he staked claims at the time of the first excitement in that district. Wada stated that when he left Fort Norman it was expected that drilling operations would be started in five places about the first of May, and that some interesting information may be expected when the first boat from the district arrives, which will be about the middle of June. The Imperial Oil Company has established four camps in the district.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST.

Reported to Canadian Chemistry and Metallurgy by A. E. MacRae, Ottawa.

Note.—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Process For Electro-Plating Metal Goods.

F. Kirschner, 217,404, Mar. 28, 1922. Metal goods are plated, specifically sheet iron is plated with Sn, by cleaning, pickling and electro-plating the goods, then fusing the deposited coating on to the metal while it is in contact with an adhesion flux and removing the residue of the flux with acidulated water. The article is then cleaned and dried. Apparatus is also specified.

Detachable Puddle Rod and Blade.

L. W. Jones, 217,075, Mar. 28, 1922.

Open-Hearth Furnaces.

J. D. Jones, 217,075, Mar. 21, 1922.

Slag Disintegrator.

A. G. Carlson, 217,211, Mar. 2, 1922. Molten slag is delivered on to a whirling plate and subjected to horizontally directed air blasts as the slag is discharged from the edge of the plate. Apparatus is specified.

Electric Arc Furnaces.

F. von Schlegell, 216,774, Mar. 14, 1922. A pair of parallel electrodes is inserted in a chamber in proximity to each other in such a way that the distance between them may vary under the influence of the magnetic fields set up in the furnace. An auxiliary electrode movable to contact with the pair of electrodes to form an arc may also be provided.

Aluminium Chloride.

E. R. Wolcott, 217,051, Mar. 21, 1922. A mixture of Al silicate material and oil shale or low grade coal, is heated to distill or burn off hydrocarbons, and the residue containing silicate mixed with C is heated with Cl to produce Al Cl. The hydro-carbons produced may be used in heating the materials.

Electrolitic Separation of Metals.

C. Langer, 217,127. Mar. 2, 1922.

Process of Producing Resin.

S. P. Miller, 217,322, Mar. 28, 1922. Naphtha containing coumoronc or indene is given a preliminary wash with H_2SO_4 to remove impurities which might discolor the final resin. The washed oil is cooled to below 20 deg. and agitated with about 5 per cent. of strong H_2SO_4. $AlCl_3$ may be used instead of the H_2SO_4 to polymerize the oil. The mixture is allowed to settle, the polymerizing agent removed and the naphtha containing the resin is distilled to remove heavy oils.

Magnesium Compounds.

V. M. Goldschmidt, 216,799, Mar. 14, 1922. Olivine and Serpentine are treated with HNO_3 of 25-40% strength at 50-90° to convert the Mg content to a nitrate in solution and the silicic acid is separated in an easily filterable state.

Magnesium Chloride.

V. M. Goldschmidt, 216,673, Mar. 14, 1922. O compounds of Mg are subjected to chlorination at 200-700° in the presence of volatile S. which is not combined with O, and in the absence of substances capable of forming water. Free S or S_2Cl_2 may be used and the chlorination must be affected below the m. p. of the anhydrous $MgCl_2$.

Metallurgical Processes.

C. H. Gilson, 216,671, Mar. 14, 1922. Ores to be subjected to a subsequent lixiviation are treated with a nitriferous reagent, such as a solution of KNO_3. The mixture may then be exposed to the air at ordinary temperature or it may be heated or calcined.

Producing Anhydrous Sodium Sulphate from Natural Deposits of Sodium Sulphate.

C. W. Hancock and C. Ide, 216,621, Mar. 14, 1922. Glauber salts from natural deposits are heated to 33° or higher to dissolve the salt and NaCl is added to partially or completely precipitate the anhydrous Na_2SO_4.

Manufacture of Ductile Alloys.

A. J. Liebmann, 217,182, Mar. 21, 1922. A mixture of metallic W, an oxide of W, an oxide of Ti and an additional quantity of an oxide of W, is subjected to a combined reducing and sintering operation so that the reducing action runs somewhat ahead of the sintering in order that the oxides can exercise their action of retarding the formation of coarse crystals before the hollow spaces between adjacent particles are closed up.

Manufacture of Steel.

A. H. Henderson, 216,946, Mar. 2, 1922. In the production of steel the metal is treated in a furnace or converter with $CaCl_2$, anhydrous alum and anhydrous borax to purify the metal which is then tapped to a ladle and about 5 lbs. pb. per ton of metal is added to increase the ductility, malleability and tenacity of the metal.

Lead Alloy.

J. P. Arend, 217,397, Mar. 28, 1922.

"Gels For Catalytic Purposes."

W. A. Patrick, 217,365, Mar. 28, 1922.

Synthesis of Ammonia.

G. Claude, 216,347, Mar. 28, 1922. NH_3 is prepared by passing a mixture of N and H through a series of catalytic bodies under a pressure of 400 to 200° atms. and 500 to 700° and collecting the NH_3 formed in individual members of the series before passage of the mixture through the other members.

Treatment of Iron Ores.

F. A. Eustis, 217,243 Mar. 28, 1922. The Fe is dissolved from the ore with a suitable solvent, the solution is reduced with SO_2 in the presence of $CaCO_3$ and the Fe is removed by electrolysis. The Alumina may be dissolved with the Fe and then removed from the solution.

Process of Treating Ores.

A. Silver, 217,519, Apr. 4 1922.

Pure Nickel from Impure Oxides of Nickel.

I. DeF. Lamothe, 217,517, April 2, 1922. Finely divided impure NiO is partially reduced with charcoal and the finely powdered material lixiviated with weak solutions of HCl and HF, then agglomerated into blocks which are calcined with powdered charcoal and lime.

Production of Nitriles and Acids.

F. A. Strauss, 217,487, April 4, 1922. Common sand is added to the mixture of sulphonate of benzene and the corresponding cyanide before heating to produce the nitrile. The latter may be hydrolyzed with acid or alkali to produce acid. The addition of sand of about 60-100% of the weight of the mixture very materially increases the yield of nitrile.

Anesthetic Compounds.

O. Kamm and R. Adams, 217,486, April 4, 1922.

Decomposition of Nitrogen Compounds of Titanium.

G. P. Guignard, 217,443, April 4, 1922.

Manufacture of Refractory and Insulating Products.

G. L. Dimitri and J. E. Delannay, 217,417, April 4, 1922. A natural Mg silicate is mixed with other silicates; the mixture is compressed, dried, formed into blocks and fired at about 1450° in a muffle furnace. The compression may take place in a vacuum.

Electrolytic Cells.

John Cranston and Wm. D. LeBar, 217,414, April 4. 1922. An electrolytic cell adapted for Cl production has a body portion of impervious material, the top and side faces of which are cut away to provide openings, leading to the electrolyte chamber, electrodes extending into the chamber, a plate supporting the electrodes and forming a closure for the openings in the top face of the body portion and means for detachably fastening the plate to the body portion. The electrodes are metallic plates turned up at the lower ends to form on each a trough adapted to receive liquid.

Apparatus for the Protection of Esters.

A. A. Backhaus, 217,702, 217,703, April 11, 1922.
A. A. Backhaus, 217,702, April 11, 1922.

Arsenical Preparations.

O. Lowry, 217,691, April 11, 1922.

Method of Treating Magnesite.

R. D. Pike, 217,635, April 11, 1922. The soluble lime content of calcined Mg° is reduced by agitating the material in a closed vessel at a temperature of 300-600° in the presence of a gas containing CO_2 and a trace of water vapor.

Apparatus for the Manufacture of Acetic Acid.

H. W. Matheson, 217,626, April 11, 1922. A reaction vessel is connected with a reflux condenser and has means for regulating pressure therein and a duplex coil through which heating and cooling agents may be circulated. An air pipe leading into the vessel has a spiral portion at the bottom with downwardly opening perforations therein, through which streams of air are circulated to maintain the bottom of the vessel clear of sediment.

Recovering Waste Acids.

H. W. Matheson. 217,625. April 11, 1922. The vaporous product of acetone manufacture are passed through alk solus. and the heat of the gases is used to maintain the temperature of the solution sufficiently high to keep the acetone in vapor form and conc. the acetate solution formed until crystallization will take place at a lower temperature then cooling the solution. The vapors may be passed through a series of alk. solutions.

Manufacture of Acetic Acid.

H. W. Matheson, 217,624, April 11, 1922. Air is passed into CH_3CHO containing a catalyst under 20 to 120 lbs. per square inch press and a temperature of 25-70°. The temperature should be maintained below the b. p. of the aldehyde at the press acid.

Acetic Anhydride and Acetaldehyde from Ethylidene Diacetate.

M. J. Marshall, 217,576, April 11, 1922. H_3PO_4 is added to the $CH_3CH\ (OOC\ C\ H_3)_2$ in small quantities, as catalyst, until most of the diacetate is decomposed in a vessel fitted with a rectifying column and a condenser. The amount of $(CH_3CO)O$ is increased and the acetic acid decreased over previously known methods.

Manufacture of Acetic Anhydride.

H. W. Matheson and G. E. Grattan, 217,575, April 11, 1922. C_2H_2 is passed through $CH_3C\ OOH$ of 96% to 100% conc. at a temperature of 60-200° in the presence of finely divided Hg. salt. The acid is violently agitated during the reaction and super-atmospheric pressure may be used.

BUFFALO FOUNDRY ACQUIRE COPPER-SMITHING BUSINESS.

Buffalo Foundry and Machine Co., Buffalo, N.Y., have recently acquired the copper-smithing business formerly conducted by W. A. Case & Son Manufacturing Co., of Buffalo. This new department will enable the Buffalo Foundry and Machinery Co. to render a more complete service to customers, as they are now in position to furnish all kinds of copper work, including copper distilling apparatus, copper evaporators, copper kettles, copper vacuum pans, copper coils, etc., and do a general copper-smithing business either in new work or repairs.

Consolidated Mining and Smelting Co. of Canada, Ltd.— The annual report of the Consolidated Mining and Smelting Co. of Canada, Ltd., for 1921, shows earnings of $338,447 available on the outstanding stock, as against $40,326 for 1920. Sales during the year amounted to $7,516,865, as against $7,227,611 in 1920. Other revenues brought the total income to $10,561,834, as compared with $10,887,205 in 1920. After deductions there was available for bond interest and dividends $570,043, an increase from $291,349 the previous year.

INDUSTRIAL ITEMS.

Vancouver, B.C.—Shelley Bros., Limited, are erecting a model bakery at 11th Avenue and Ash Street, 300 x 125 feet, four storeys high. The total cost, including machinery, will be about $500,000.

Prince Rupert, B.C.—The new $50,000 C. N. R. depot here is rapidly nearing completion.

Victoria, B.C.—The Western Abrasive Co., Ltd., with J. L. Near as president, has commenced operations. Sandpaper will be manufactured, and as British Columbia alone imports $75,000 worth a year, the company expect a profitable business. The company is using as abrasive material a hard crystalline quartz from the Prince Rupert district. Over $500,000 worth of sandpaper is imported into Canada each year.

Kingston, Ont.—The Frontenac Floor and Wall Tile Company has secured the contract for furnishing the new Mount Royal Hotel, Montreal, with porcelain flooring and tiling.

Port Arthur, Ont.—The Palatin Steel Co. are planning to start operations, introducing electric smelting of iron ore. The engineers of the company are at present in Sweden studying the electric processes. Power would be obtained from the Port Arthur hydro-electric plant at Cameron Falls.

Winnipeg.—Ten thousand acres in Stony Mountain district, 15 miles north of Winnipeg, have been leased by United States interests for oil exploration.

Port Colborne, Ont.—The International Nickel Co. has dismantled its plant at Bayonne, New Jersey, and has moved the machinery and equipment to the Port Colborne plant, where all matte from Sudbury will be refined in the future.

Sarnia, Ont.—The Dominion Alloy Steel Corporation was granted a fixed assessment of $300,000 for ten years, by a by-law carried by a large majority of the ratepayers. It is expected that excavation work on the $5,000,000 plant of the corporation will commence within a few weeks.

REPORT ON ONTARIO GOLD DEPOSITS.

The Ontario Department of Mines has issued as Part II, Vol. XXX, a report on "Ontario Gold Deposits, Their Character, Distribution and Productiveness." The report, covering 73 pages, was prepared by Percy E. Hopkins and was presented in abstract form at the annual meeting of the Canadian Institute of Mining and Metallurgy, March, 1922. The report is one of the most complete presentations of the gold mining situation in Ontario ever published and forms a very valuable contribution to the mining literature of Canada. The purpose of the report was to give an historical summary of gold mining in Ontario and a description of the geological features of the several gold fields as related to the ore deposits. Notes on the character of the deposits themselves, their production and development are also included. The maps accompanying the report are excellent, showing the location of the producing gold mines and of many gold prospects, as well as railway stations, waggon roads, hydro-electric power plants and transmission lines serving the gold mining industry. The statements of gold production in the report were complied by W. R. Rogers, statistician of the Department; the maps were drawn by H. C. Smith, cartographer of the Department. Mr. Hopkins also expresses his indebtedness to Dr. W. G. Miller, Provincial Geologist, and to T. W. Gibson, Deputy Minister of Mines, for numerous suggestions. Copies of the report may be obtained from the Ontario Department of Mines, Toronto.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, 1922

The Eighth National Exposition of Chemical Industries will be held this year in the Grand Central Palace, New York City, during the week, September 11 to 16, inclusive. It will follow immediately upon the Fall Meeting of the American Chemical Society. "Raw Materials, Machinery, Products," is the way the Exposition is described, and is intended to carry this main impression. The raw materials are exhibits of the natural resources from out of the earth and above the earth. The machinery exhibits consist of apparatus and equipment and instruments for control, precision, recording, gauging, measuring, and machinery for every mechanical operation in the manufacture of products from the raw materials. The products themselves are the finished products and the exhibits will contain those of organic, and inorganic origin, of solid, liquid, or gaseous form, and of every conceivable nature.

Each year there are many new articles exhibited. Counting only these; the time of technical and business men is well and advantageously spent in inquiring into the things on exhibit.

One exhibitor who, for the past few years, has been devoting time to the perfection of a new form of apparatus, said the other day that it is now when men have time to spare for consideration of these things that he expects considerably larger and more interested attendance in his booth.

The managers report that three full floors of the Grand Central Palace are already taken for the Exposition, and part of the fourth. There are at this time, 350 exhibitors who have contracted for their space locations.

The program of the Exposition has been outlined, and work is now in progress upon it, and it may be expected to compare fully with the high standards of the preceding Expositions. As has been the custom, there will be exhibits of motion pictures covering all phases of the chemical industries, and the Exposition will hold many interests for every visitor.

The office of the managers, Charles F. Roth and Fred W. Payne is in the Grand Central Palace, New York City, and inquiries should be directed to them there.

Chemical, Oil and Metal Markets

The quotations below represent manufacturers' and wholesale importers' prices at Toronto, Montreal, or other Canadian points

CHEMICALS.

The falling off in trade in chemicals noted at the beginning of May was fortunately of short duration. It lasted for about two weeks and was followed by a revival of trade that has been very encouraging. It would not seem to be correct to assume that the renewed activity of the market was due to the decline in prices that occurred about May 1st, for in spite of the lowering of prices on most of the industrial chemicals, enquiries actually fell away off and as already stated, did not resume until about May 15th. The splendid come back to trade is due no doubt to the natural increase in the demand from the various consuming industries. The steel mills are coming more and more into the market every day, due to advances in construction work. Demand from the textile mills is the best it has been for some time. Many Canadian textile mills are running night and day at present and naturally their demand for chemicals has been very good. The paint and varnish and packing house industries are also taking more than they have for a long period, while the rubber industry is becoming more active in the chemical market every day. Of all the allied industries the leather possibly shows the least improvement from a buying standpoint, but even in its case there is a fair advance over even a few months past.

Quotations have remained remarkably firm and are holding so as June opens. After the declines registered about May 1st, there has been very little change one way or the other. Due to the advances in copper and zinc, quotations have gone up on copper sulphate and zinc oxide, but with these exceptions there is very little change.

METALS.

The long expected advance in copper has at last occurred. Of all the metals, copper has been the very last to respond to the reconstruction period. The market has been cleared pretty well of second hand lots of copper and while there are surplus stocks in some quarters, yet these are in good hands. The thanks of the entire public are due to those who have been handling the copper situation, for had it not been for careful control of surplus stocks and second hand material, the big refineries would be closed and thousands of men out of work. The rise in copper has meant an advance of over $1.00 per cwt. since May 1st, a very creditable showing. From now on, the natural law of supply and demand will rule the copper market, and there is every reason to believe that the demand will keep up from now on.

Zinc and lead are both stronger and a nice increase in business in these metals has taken place during the month.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.50— 5.00
Ammonium Bromide	Lb.	.. — .38
Aluminium Sulphate, bags	100 Lbs.	.. — 2.50
Aluminium Sulphate, iron free	Cwt.	.. — 4.50
Ammonia, Aqua, 26, Carboys	Lb.	.. — .14
Ammonia, Aqua, 26, Drums	Lb.	.. —.09½
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb.	.. — .14
Barium Sulphate (Barytes)	Pre Ton	30.00—35.00
Barium Chloride	Lb.	.04½— .06
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb.	.. — .22
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	.02½— .03
Borax, crystals	Lb.	.07⅓—.07¼
Boric Acid, powdered	Lb.	.. — .13
Bromine (technical)	Lb.	.. — .38
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —95.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	..—100.00
Calcium Chloride, fused	Per Ton	36.00—38.00
Calcium Chloride, flake	Ton	40.00—42.00
Caustic Soda, ground, drum	Cwt.	5.50— 6.00
Caustic Soda, solid, drum	Cwt.	4.50— 5.00
Camphor **Monobromate**	Lb	.. — 3.00
Carbon **Bisulphide, in drums**	Lb.	.. — .11
Carbon Tetrachloride, drums	Lb.	.19— .20
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, imported	Per Ton	20.00—25.00
Cobalt Oxide, black	Lb.	.. — 2.00
Cobalt Oxide, grey	Lb.	.. — 2.25
Copperas (Iron Sulphate) crystals	Lb.	.02—.02¼
Copperas (Iron Sulphate) sugar	Lb.	.02—.02¼
Copper Sulphate (Blue Vitriol)	Lb.	.07—.07½
Corrosive Sublimate (Mercuric Chloride)	Lb.	.. — 1.10
Fluorspar, ground	Tons	.. —30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.11— .12
Ferric Chloride, solution	Lb.	.. — .10
Hydrofluoric Acid, 60%	Lb.	.. — .28
Hydrofluoric Acid, 30%	Lb.	.. — .13
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	.70— .75
Iodine, crude	Lb.	.. — 4.50
Iodine, resublimed	Lb.	.. — 5.25
Iron Oxide (red)	Lb.	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.14 — .15
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.09— .10
Lithium Carbonate	Lb.	.. — 1.70
Lithopone	Lb.	.06— .07
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl	Lb.	.09— .11
Magnesium Sulphate	Lb.	.03— .04
Mag. Sulphate, B.P., Medicinal	Single Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Muriatic Acid, 18	100 Lb.	2.75— 3.00
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt.	Lb.	.. —.16½
Nickel Salt, double, barrel lots	Lb	.. — .15
Nickel Salt, double, per cwt.	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lb.	.09—.09¼
Phosphoric Acid, 85%	Lb.	.. — .28
Phosphoric Acid, 50%	Lb.	.. — .22
Phosphorus, yellow	Lb.	.. — .34
Potash Prussiate, yellow	Lb.	.28— .30
Potassium Bicarbonate	Lb.	.. — .20
Potassium Bromide, crystals	Lb.	.22— .30
Potassium Bromide, granular	Lb.	.22— .30
Potassium Bichromate	Lb.	.. — .25
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .08
Potassium Chlorate	Lb.	.. — .10
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .80
Potassium Hydroxide (caustic potash) small drums	Lb.	.15— .20
Potassium Hydroxide (caustic potash) large drums	Lb.	.08— .10
Potassium Iodide	Lb	.. — 4.10
Potassium Nitrate, casks	Lb.	.. — .10
Potassium Permanganate, bulk	Lb.	.65— .70
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. — 9.00
Soda Ash, bags	Cwt.	2.40— 2.50
Sodium Acetate, ton lots or over	Lb.	.. —.06½
Sodium Acetate, lesser amounts	Lb.	.. —.07½
Sodium Benzoate	Lb.	.45— .50
Sodium Bicarbonate, 100% pure	Lb.	2.50— 3.00
Sodium Bichromate, bbls	Lb.	.10— .13
Sodium Bisulphite, powder	Lb.	.. — .06
Sodium Bisulphite, 35	Lb.	.05½— .06
Sodium Bromide (foreign)	Lb.	.30— .35
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. — .31
Sodium Hyposulphite, kegs	100 Lb.	5.85— 6.00
Sodium Hyposulphite, barrels	Cwt.	5.25— 5.50
Sodium Iodide	Lb.	.. — 4.60
Sodium Nitrate, refined	Cwt.	6.00— 6.50
Sodium Nitrate, crude, 95%	Cwt.	5.00— 5.75
Sodium Nitrite	Lb	.12— .15
Sodium Peroxide, f.o.b. New York	Lb.	.30— .35
Sodium Silicate, 42°, car lots	Cwt.	.. — 1.40
Sodium Silicate, 42°, smaller lots	Cwt.	.. — 1.60
Sodium Silicate, 40°, car lots	Cwt.	.. — 1.30
Sodium Silicate, 40°, smaller lots	Cwt.	.. — 1.50
Sodium Sulphate (Glauber's Salts) crystals,		
	Per Cwt. in Bags	1.90— 2.00
	Per Cwt. in Car Lots	1.65— 1.70
Sodium Sulphite	Lb.	.. — .05
Sodium Prussiate, Yellow	Lb	.18 — .19
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	4.00— 4.25
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars		23.75—24.00
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Ton	.. —23.00
Tin Chloride crystals	Lb.	.30— .35
Tri-sodium Phosphate	Lb.	.08—.08½
Ultramarine, Blue	Lb.	.15— .35
White Precipitate (Mercuric-Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	.. —30.00
Whiting (American)	Ton	.. —30.00
Zinc Sulphate, com.	Lb.	.05—.05¼
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.10—.11½
Zinc Stearerate	Lb.	.. — .75

Organic.

Acetanilid, C. P.	Lb.	.45— .50
Acetic Acid, glacial, carboys, f.o.b. Shawinigan Falls	Lb.	.. —.20½
Acetic Acid, glacial, bbls., f.o.b. Shawinigan Falls	Lb.	.. — .20
Acetic Acid, 28%, carload lots	Lb.	.. — .04
Acetic Acid, 28%, 25 bbl. lots	Lb.	.. —.04¼
Acetic Acid, 28%, 10 bbl. lots	Lb.	.. —.04½
Acetic Acid, 28%, 5 bbl. lots	Lb.	.. —.04¾
Acetic Acid, 28%, 1 or 2 bbl. lots	Lb.	.. — .05
Acetic Acid, 80%, carload lots	Lb.	.. — .12
Acetic Acid, 80%, 25 bbl. lots	Lb.	.. — .14
Acetic Acid, 80%, 15 bbl. lots	Lb.	.. — .15
Acetic Acid, 80%, 10 bbl. lots	Lb.	.. —.15½
Acetic Acid, 80%, 5 bbl. lots	Lb.	.. — .16
Acetic Acid, 80%, 3 or 4 bbl. lots	Lb.	.. — .17
Acetic Acid, 80%, 1 or 2 bbl. lots	Lb.	.. —.17½
Acetone, pure, drums or over	Lb.	.. —.19½
Acetone, pure, lesser amounts	Lb.	.. — .25

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TABLE OF CONTENTS

EDITORIALS:

Page
- What About a Name? 143
- The Way of a Man With a Money Bag 143
- Great News from Syracuse 144
- How We Talk 144

Registered Professional Engineers — Modified Bill Passes Ontario House 145

The Determination of Arsenic in Cobalt Ores and Cobalt Nickel Speiss by the Distillation Method
By C. A. Knittel 146

Electrolytic Extraction of Cod Liver Oil 147

The Relation Between Gas Evolved and the Digestion of Sewage in Activated Sludge
By George H. Lucas 148

Petroleum Production in United States 151

The Action of Several Salt Solutions on Aluminium, Copper, Lead and Zinc
By Cyril H. Crowe 151

New Edition of "American Research Chemicals" 152

New Process for "Cracking" Heavy Crude Oils 152

Page

Iron and Steel: A Great Maritime Province Industry
By W. F. Ingalls 153

The Manufacture and Use of Black Pigments
By H. L. Blachford 156

American Leather Chemists' Convention—Report of 19th Annual Meeting, Muskoka 159

Chemical Engineers Visit Toronto 160

Chemical Equipment Manufacturers Organize 161

Annual Meeting of American Oil Chemists' Society 161

World Conditions and News in Chemical Fields 162

Mining and Metallurgy in British Columbia 163

Distillation Method for Determining Volatility of Natural Gas Gasoline 164

Latest Chemical and Metallurgical Patents
By A. E. MacRae 165

Report on Barium and Strontium in Canada 165

Industrial Items 166

Market Review 167

Buyers' Guide 43

Index to Advertisers 52

FROM THE PUBLISHERS—

THE POWER OF ADVERTISING

Advertising has made modern world-wide business possible, and has lowered the individual cost of a very large number of products, because of the mass production made possible by wide sales. Advertising educates the Market to the Product. It reduces the resistance to the sales effort and does more than any other force to create an attitude for further favorable consideration.

Sound advertising takes into account some particular and definite market and is part of a logical plan to secure business in the field. This plan is worked out after the general manner of a piece of chemical research. If advertising copy appeals to you, it is good practice to try to estimate what there is about it that arrests your attention and creates a desire on your part for the product. The business of creating advertisements, particularly in the technical field, offers some opportunities for the engineer and the artist to work together. If good advertising is a science, the man with the trained, scientific mind should be able to eliminate waste and secure positive results in this field as in others. Become a student of advertising. It will make you a keener buyer.

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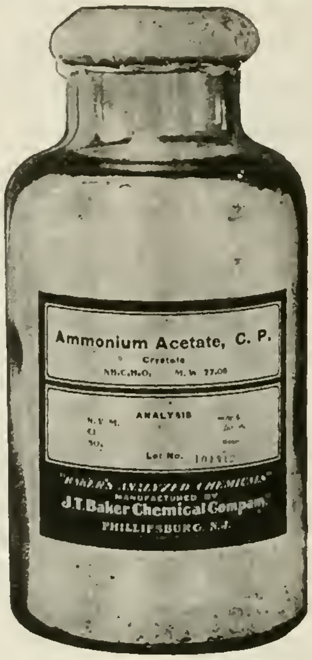
Dependable Reagents—



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EDITORIALS

WHAT ABOUT A NAME?

OTHER designations would probably have no more effect on a chemist than on a rose, though chemists have been popularly associated with emanations that, as Trinculo puts it, cause "great indignation to the nostrils." Chemists have, however, produced colors and odors which vie with those of the rose for beauty and fragrance.

It is becoming apparent that chemists need to be more definitely labelled. We have several names, fitting with varying success the different occupations which deal with chemical reactions. Nearly all of these are applied to the dispensing business. To the general public the word chemist itself conveys the idea of dispensing medicines.

There are chemists in manufacturing industries, there are others, whose duties are those of controlling our water supplies and there are chemists whose work lies in the domain of agriculture. There are consulting chemists, biologic chemists, and chemists who lecture to university students. All of these men work in an entirely different department of scientific endeavor. Legally, in the Province of Ontario, and possibly in others also, the term chemist is only used with reference to apothecaries or druggists.

Can we not appropriate a term which shall apply to the man or woman who practises chemical analysis, assaying, or industrial applications of chemistry? The name " CHEMOR " has been suggested.

This name was openly proposed at the recent meeting of Chemists at Ottawa and has been the subject of a few conversations since then.

It is proposed that a special word such as this might be specifically applied to the second great class of chemical workers. Canada might well take a lead in a matter of this kind. If a new name for chemists was developed which could be used in legitimate publicity for reliable members of the profession a vast amount of explaining would soon become unnecessary.

We suggest that the word be used a little, rolling it round on the tongue listening to it in conversation and trying it out generally. It is advisable that "CHEM" be a part of any such name, and also that the name itself be short. CHEMOR seems to fit pretty well. It sounds smoother to us now than at first. We have to confess a certain sense of insufficiency when we first heard it, but we are now prepared to back it up as a good designatory appellation and recommend it to our gentler readers.

THE WAY OF A MAN WITH A MONEY BAG

SOLOMON expressed unsatisfied curiosity about several things in nature, but did he come into contact with a prototype of the financier of to-day?

A bank return showed a bank to be sound, when the facts in the possession of some of its directors showed it to be heavily involved. The men who made the returns knew it to be involved when they made those returns.

Technical sinuosities make it possible for a judge to declare that no wilful negligence or deceit had taken place and that the parties signing reports to the government, reports on which our whole system of finance depends, could not be held responsible for the details over which they were paid large salaries to maintain supervision.

A company making boots and shoes takes over a rubber concern, meets war conditions, gets large business, confronts excess profits tax, sinks it "spurlos versenkt" in tire and other businesses, issues bonds, creates preferred and common stock, which the man with real money buys; pays big salaries, and after a spectacular career on the stock market, finds itself inflated beyond the yield point. With no business to keep up the pressure, deflation can only result in collapse and there are proposals to throw overboard the common stock sand bags.

A large pulp and paper concern had a like history. This company and many others in similar position were allowed to issue notes which the government accepted in lieu of money for taxes, claiming in one case that pressure for cash would have embarrassed the company financially, while the poor thing was only able to pay 10% dividends.

We are bringing these things up, not because we are competent to discuss them. We can say frankly they are not in our province, but we "stand gast" as Togo says. The men who handle financial matters have been surrounded with an aura of mahogany, marble, motors and mystery.

The engineers, chemists, machinists, spinners, paper makers, shoemakers, who are concerned with materials that give money its raison d'etre, are pondering about this strange thing under the sun. It is all very well to say the squall of bad times struck these financiers, but they of all people knew the weather signs and went into the squalls with all sails set, and put up some extra canvas, and there's much need for canvas now while our big credits are fluttering in ribbons from the masts.

Surely now we can expect that there will be a change in physicians. We must dig and plough, and cook and spin, and the men who can best direct the digging and ploughing, cooking and spinning must be the masters of our fate to a greater degree than has up to now been permitted.

We need men of broad vision in law and finance as much as we need scientists, superintendents and schoolmasters. We must, however, secure better proportions in the valuation of service.

GREAT NEWS FROM SYRACUSE

WE were disturbed in our risibilities recently by a wonderful little news item dated from Syracuse, N.Y., as to assays of "puzzling limestones and other formations" of Northern New York and Canada. These were studied by a gentleman who came to Canada "some number of years ago." "He then heard about the Northern New York deposits. These deposits—extended far into Canada."

He "studied them," and became "convinced there were values in that section," and with Frasch-like adequacy sent a sample of twenty tons of the Canadian ore to a reduction company "several hundred miles away." Being an enthusiast, the trifling matter of freight did not bother him, nor did the fact that nothing was found in such a moderate sample as twenty tons deter him from going further afield. This brought him to Toronto, where he "came into contact with other persons seeking to solve the same question." They had "a different kind of assay." Being parties of large distances it was decided to ignore any North American assayers as being too local or something or other, and so a sample, likely only a ton or so to save postage, was sent to Sir Wm. Ramsay, possibly getting his address from Sir Arthur Conan Doyle. "The new method of analysis was also sent with the request that he run it according to directions." Sir William was lucky beyond expectations. His "final" result (It took some trying, no doubt, the poor fellow not being versed in that kind of assay) showed "four ounces of gold per ton and four and one-half ounces of platinic metals per ton." It was noted that the English assayer was surprised, as he is stated to have warned the parties to be sure of having a "sufficient quantity of this rich ore **on hand before** we started mining."

We thought at first when we read this, that we had met our old friend the "green" or "immature" gold, which haunts the Adirondacks. This is not the case. Something far more Curiesque or Langmuirish is subtly lurking here, some kobold gleefully frustrates everybody other than Mr. Jordan of Syracuse and his Toronto friends. Here is the last paragraph of the news item.

"The discovery that a substance does not exist in ores which does actually break down into the metal and is capable of being made to break down on a commercial scale, would seem to indicate the possibility of adding materially to the present supply of precious metals, which, if pursued with care and conservatively, might mean relief from the present shortage of many metals." We are pleased to note the word "conservatively." This indicates that Mr. Jordan is seized of the possibility of serious glutting of the market.

We might not have referred to this except that some of our worthy friends may soon be approached to assist in relieving the shortage of precious metals among the promoters of some new get-rich-quick scheme to amplify our history of fakes, and exercise the genial barrister who may have to pass on the prospectus, according to recent legislation.

HOW WE TALK

A CONTRACTING firm put in a tender for a Government job. They received a letter accepting it, and their president acknowledged the letter, but added a brief sentence giving his view of what the contract was "to prevent any misunderstanding." That sentence cost them something over $100,000.00 in the outcome. The contract was not completed, because something was added that the other party had not agreed to. If the bare acknowledgment had been sent, the contract would have been completed.

It is so easy to say too much. We have been looking through the chemistry examination paper in a provincial report. One question calls for the completion of an equation, and adds, "give all the information it conveys to you." Those two monosyllables at the end make it logical to expect marks with any kind of an answer.

Here is another. "You desire to prepare a sample of pure ammonium nitrate. Give in detail every stage of the process you would adopt." To answer that question it is not necessary that your process produce ammonium nitrate. It is only necessary to give the process "you would adopt." Those last three words change the whole import.

No wonder Barrie when saying that the scientist was the only man who had something to say, added that he was also the only man who did not know how to say it.

While talking of examination questions, here's one that would require a Daniel to answer. "A manufacturer desires to produce 10 tons of 95% sulphuric acid. How much iron pyrites (FeS_2) and what weight of steam must he provide." It was really very considerate to throw in that formula for iron pyrites, it clears up one point anyhow.

We often hear of "howlers" in answers to questions. How about some of the questions?

TORONTO CHEMISTS HAVE A LUNCH CLUB

Any chemist who is passing through Toronto or has to live there may be cheered by a chat with his mates if he drops in at the Engineers' Club, 90 King Street West, on Mondays at 12.30 for lunch. If he is not a member there he can be the Dutch guest of any of us who are. This is going to be one of our best social features. If you live in Toronto, make it a regular date. If you do not, try to make your business fit in with this Monday Lunch.

REGISTERED PROFESSIONAL ENGINEERS

A Modified Bill including Chemists, Passes Ontario House

At the last moment, the Ontario Government passed the "Act Respecting Professional Engineers," as a Registration Bill only. The Advisory Conference Committee has now turned over their work to the Provisional Council. Keen disappointment was felt that the complete aims desired were not reached. At the same time, it was judged better to accept a Bill, even without the penalty clauses, than to have the legislation dropped entirely.

What has been secured amounts to this:—

1. Members of the Association will be entitled to full recognition under the laws of the other provinces.
2. A distinct designation is provided for, which is protected, and which the Association can, by hard work, cause to be recognized more widely by the public as time goes on.
3. An association is created, which will solidify the Professional Engineers of Ontario into an effective instrument for carrying the matter further.
4. All future applications for more restrictive legislation will be made in the name of an organization which the Legislature has itself created, and which it must fully recognize without question.
5. Any further concessions will involve only a short clause or two. It will not be necessary to submit a large number, each one of which opens the way to petty criticism.
6. The lack of any restriction on practice will enable the Association to set up a much higher standard for admission to membership. This is the most important result, as, under the original Bill, it was expected that no one would be deprived of an established method of livelihood.

Such opposition as arose in the House came from all classes of members, political and occupational. It is evident that the professional engineers of this province can secure their desires only by a united demand, and real work. Nothing is likely to be granted them without an effort. If those qualified join the new Association, they may hope to secure all their objects in a reasonable time at small expense. If they stand aloof, because they cannot be translated into an engineers' heaven at one swoop, the Association will shortly expire.

If this should happen, it would be a sad blow for future legislation along this line, for engineers in general, or any particular group of them.

It must be remembered that this Bill includes Chemical Engineers and may well be interpreted to include all chemists. Referring again to the definition of "Professional Engineer," we quote from the Bill, as passed, as far as chemists are concerned: "Professional Engineering shall mean the advising on, the reporting on, the designing of, the supervising of the construction of chemical and metallurgical machinery, apparatus and processes." It is obviously evident that this extract was not designed for chemists, alone, but is construed to include them.

The Bill provides a Provisional Council, with Charles H. Mitchell as president, Robert A. Bryce as vice-president, and sections, representing Civil, Mechanical, Chemical, Electrical and Mining Engineers. In this part of the Bill, the term "Chemical Engineering" is alone used. The members of this Council, appointed under the Act to represent Chemists are: J. W. Bain, S. F. Kirkpatrick, and Harold van der Linde.

Penalties are provided for falsely claiming the designation of Professional Engineer. The whole matter may be summed up by saying that registration is advisable, but not compulsory, and anyone who has been engaged in engineering, as defined, for five or more years in the province, is entitled to registration without examination. The Bill, on the whole, is lenient enough about admission.

A copy of the Bill should be secured by all chemists, and thoroughly examined. Admission of chemists is wholly in the hands of their own representatives on the Council. The Bill passed the Ontario House on the 5th of June, and is known as Bill No. 67, of the third session of the 15th Legislature.

NEW PRESIDENT OF NATIONAL DRUG AND CHEMICAL CO., LIMITED

Mr. Charles W. Tingling has been appointed to succeed Mr. D. W. Bole as president of the National Drug and Chemical Co., Ltd., who has retired from the presidency after sixteen years of active service as the chief executive of the company. It was due largely to Mr. Boles' efforts that the several drug companies now composing the National Drug and Chemical Co. were brought together, and his keen foresight and advice has been of great value in guiding the efforts of the company since its inception sixteen years ago. Mr. Bole represented Winnipeg in the Dominion Parliament from 1894 to 1898, and for many years took a leading part in municipal affairs of that city.

Mr. Tingling, the new president, has been connected with the wholesale drug business in Canada for many years, having been one of the original organizers of the Dominion Drug Co. of Hamilton, Ont., one of the firms that joined together in 1906 to form the National Drug and Chemical Company. Mr. Tingling, who played an important part in the formation of the new company, became its treasurer, then general manager, and later a vice-president.

CHANGES IN PHARMACEUTICAL ITEMS OF TARIFF

A change of interest to pharmaceutical manufacturers and dealers has been made in the Canadian tariff by the recent amendments. Previously, all medicinal, chemical, and pharmaceutical preparations compounded of more than one substance were subject to a duty of 20%, when dry, or 60% preferential and general when liquid, no distinction being made as to the alcoholic content of the liquid. By the new regulations, liquid medicinal preparations imported, containing not more than 2½% of proof spirit, shall pay 25% preference, and 40% intermediate or general. In other words the effect of the new regulation is to demand the declaration of the alcoholic content of all imported medicinal or proprietary preparations.

MACDONALD COLLEGE ANNOUNCEMENT

The sixteenth annual announcement of Macdonald College, Quebec, is at hand, and the authorities of the college are to be congratulated upon the very excellent courses that are offered. The college, which is a college of McGill University, has courses in agriculture and its branches, a school for teacher training, a high school, and school of household science. The department of chemistry is under the very able supervision of Professor J. F. Snell, professor of Chemistry and assisting him are Professor J. B. McCarthy, assistant professor of Chemistry, and Mr. Everett A. Carleton, research assistant in Chemistry.

The Determination of Arsenic in Cobalt Ores and Cobalt Nickel Speiss by the Distillation Method

By C. A. Knittel

DURING the past ten years the writer has consistently used the distillation method for determining arsenic in Cobalt ores from Northern Ontario, and also in the intermediate products resulting from their metallurgical treatment. The distillation of arsenic as arsenious chloride after reduction with ferrous chloride and addition of hydrochloric acid was first described by Fischer[1]. Various substances have been proposed as reducing agents, and numerous modifications of the process have been described in the literature. Using hydrazine sulphate and hydrobromic acid as reducing agents, and the method of procedure as described below, the writer has found that the large quantities of hydrochloric acid and the repeated distillations prescribed by various writers for the complete volatilization of the arsenic were unnecessary for the materials with which he has had to deal. Rohmer[2] first noticed the accelerating action of hydrobromic acid used in conjunction with sulphur dioxide. In the writer's opinion this accelerating action may be attributed to the fact that arsenic tribromide is less readily hydrolized than the corresponding chloride. Jannasch and Seidel[3] used hydrobromic acid and hydrazine sulphate with excellent results. The reagents have again been recommended recently by Graham and Smith[4], who pointed out the interfering action of nitrates and nitrites. Failure of the distillation method can invariably be traced to the incomplete expulsion of nitric acid or its reaction products when this acid has been used as a solvent. Probably one reason against the more general use of hydrazine sulphate may be found in its comparatively high cost. Laboratories, where large numbers of arsenic determinations are made could easily and cheaply prepare this substance by the method of Raschig[5].

Reagents

Arsenic Trioxide C. P.—Samples of alleged C. P. arsenic trioxide from various sources showed non-volatile matter, and other impurities in amounts varying from 0.5-1.5%. Arsenic trioxide for use as a standard substance should meet the tests for purity as given by Chapin[6], whose method of purification has been found very satisfactory.

Standard Potassium Bromate Solution.—Contains 2.79 g. of the "pure" salt in one liter of water. Contrary to Low[7] a solution prepared from the "pure" salt, and kept away from the light, was found to be of constant value over a period of several months, when taking into consideration, changes of volume, due to variations in temperature. The solution is standardized by putting several portions of 0.15-0.20 g. of arsenic trioxide through all operations as described below. A "blank" distillation should always be made, using the same amount of reagents, but omitting the arsenic trioxide. The amount of bromate solution consumed by the "blank" (generally 0.1-0.15 c.c.) should be subtracted from that required by the arsenic trioxide.

Hydrobromic Acid C. P. (S. G. 1.34).

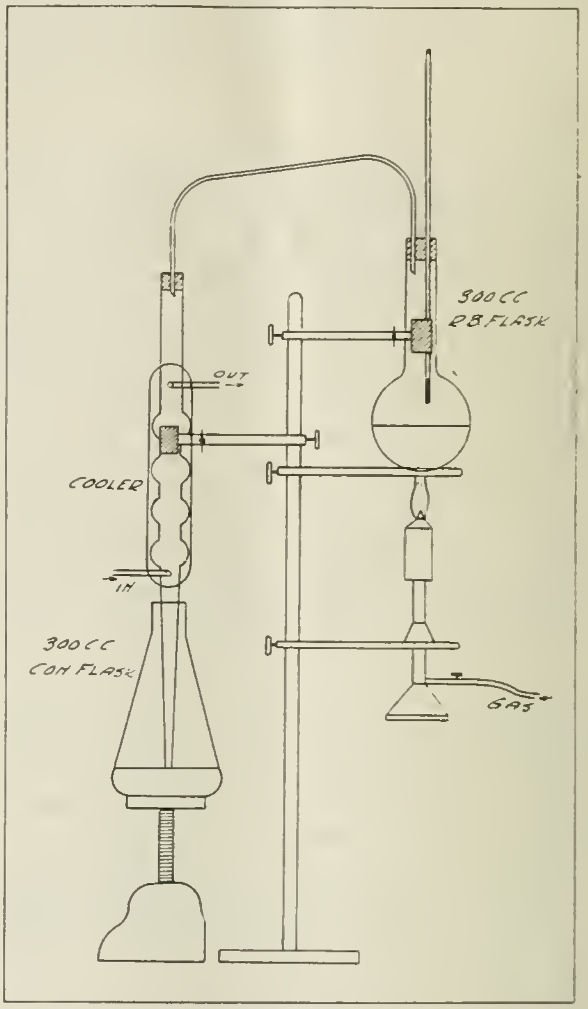
Hydrochloric Acid C. P. (S. G. 1.19).

Hydrazine Sulphate.—This may be obtained from the Eastman Kodak Company.

Methyl Orange Indicator.—0.1 g. of methyl orange is dissolved in 100 c.c. of water.

Acid Mixture.—Consists of 200 c.c. of conc. sulphuric acid, 400 c.c. of conc. nitric acid and 400 c.c. of water.

Distillation Apparatus.—As shown by the sketch, this is very simple and easily put together from materials found in any moderately equipped laboratory. It consists of a 300 c.c. r. b. Pyrex flask, a thermometer, and a delivery tube, as shown. The delivery tube is ground to a sharp angle at each end to prevent any of the solution from being carried over mechanically. The flask is connected by the delivery tube and rubber stoppers to the top of a 20 cm. Allihn condenser, the lower end of which should be about 20 cm. in length, and slightly tapered. The end of the condenser is sealed by 100 c.c. of water contained in a 500 c.c. conical flask. The conical flask is supported on a wooden stand provided with a screw adjustment so that the flask may be gradually lowered as the distillation proceeds. By thus adjusting the height of the flask so that the end of the condenser never dips more than a few mm. into the liquid, the outlet is always sealed, but the solution can never rise higher than the first bulb of the condenser. Troublesome back-suction is thus avoided, and the distillation needs very little personal attention. The thermometer should be about 3 cm. above the surface of the liquid in the distillation flask. In some cases it may be necessary to use a few small lumps of pumice in the flask in order to prevent bumping during distillation. Using ordinary rubber stoppers, it will be found that the bulbs of the condenser will be covered with a film of arsenic sulphide and some flocks of arsenic sulphide may also be found in the distillate. This trouble may be avoided by thoroughly cleaning the rubber stoppers with a strong



Distillation Apparatus for Determination of Arsenic in Cobalt Ores.

solution of caustic soda, but the writer prefers the sulphur-free stoppers which may be obtained from Eimer and Amend.

Method.—The amount of material to be taken for the determination depends upon its arsenic content, which should not exceed the equivalent of 0.5 g. of metallic arsenic, and may be so adjusted as to come within the capacity of a 50 c.c. burette, (50 c.c. bromate soln. = approx. 0.185 g. As) or the distillate may be diluted to a definite volume and aliquot parts taken for the titration.

Accurately weigh the material and transfer to a distilling flask. Add 25 c.c. of the acid mixture with the usual precautions to guard against loss due to spraying and violent reaction. When any violent reaction which may occur has subsided, grasp the flask by the neck with a suitable holder and evaporate over a bare flame until dense fumes of sulphur trioxide are evolved. Cool, add 15 c.c. of water, and repeat the evaporation to fumes. If the material contains only a small amount of silicious matter, add 1 g. of hydrazine sulphate to the sulphates in the flask, then add 20 c.c. of water, heat to boiling, and keep boiling for about one minute. However considerable amounts of silicious matter should be filtered off. In the latter case, take up the sulphates with 30-40 c.c. of water, heat with constant shaking till the anhydrous ferric sulphate generally present has dissolved. Filter through a rapid paper, receiving the filtrate in another distilling flask, wash paper and flask thoroughly with the least possible quantity of cold, dilute (1:50) sulphuric acid. Evaporate the filtrate to a volume of 20 c.c., add 1 g. of hydrazine sulphate and boil for about one minute. Cool the solution, add 60 c.c. of conc. hydrochloric acid and 2.5 c.c. of hydrobromic acid. Close the flask with the stopper carrying the delivery tube and thermometer. Connect to the condenser, the delivery end of which is sealed by 100 c.c. of water in the manner described above. Distill gently until the vapor temperature, which remains at 108° c. for a considerable time, just begins to creep above this point. The condenser should be operated in such a manner so that the distillate will not rise much above the temperature of the room. When the distillation is finished, rinse the inside and the end of the condenser with a little water. According to the amount of arsenic present, either the whole of the distillate, or an aliquot part should be taken for the titration. Care should be taken that the titration is performed under similar conditions as regards volume and concentration of hydrochloric acid, to those prevailing during standardizing the bromate solution.

For the titration which is carried out in a 500 c.c. conical flask, proceed as follows:

Heat to 70° C., pour off 10-15 c.c. into a test tube or a small beaker, to the main bulk of the solution add two drops of methyl orange, run in the bromate solution in a rapid succession of drops, shaking continuously to avoid any local excess. When approaching the end-point the color of the methyl orange begins to fade. Now add the reserved portion of the solution, rinsing the container with a little hydrochloric acid, add a further two drops of methyl orange and finish the titration by adding the bromate solution drop by drop. A little practice will enable an operator to determine the point at which the reserved portion of the solution should be added.

Notes on the Method

The acid mixture has proved satisfactory for material containing up to 6% sulphide-sulphur. For materials containing larger amounts of sulphide-sulphur, as for instance mispickel, solution in a mixture of carbon tetrachloride and bromine as prescribed by Allen and Bishop[8], for pyrites, has been found very useful. After expelling the bromine with nitric acid, sulphuric acid is added, and the solution evaporated to fumes.

As regards the completeness of volatilization of the arsenic, under the conditions as given for the method, numerous tests have been made by repeating the distillation with 60 c.c. of hydrochloric acid. The second distillate was either titrated or saturated with hydrogen sulphide. No arsenic was found even when as much as 0.6 g. was originally present.

In order to establish whether any arsenic was lost in the various operations, duplicate portions of about 0.2 g. of arsenic trioxide, accurately weighed, were put through all the steps of the process. Another set of duplicates was dissolved in a solution of caustic soda, neutralized with hydrochloric acid, 50 c.c. added in excess and the whole diluted to 150 c.c. Titrations, after deducting the "blank" in each case, gave identical results for the value of the bromate solution. This shows that the bromate solution may be standardized in a more direct way, but the writer prefers to put the standard substance through all the steps of the process.

Using hydrazine sulphate, the introduction of large amounts of fixed salts which are liable to cause bumping during the latter stages of the distillation is avoided. The residue from the distillation is readily available for the determination of other constituents after destroying the excess of the reagent with bromine water or hydrogen peroxide.

The method is intended for moderate to large percentages of arsenic. In a subsequent article it will be shown how to apply this method for the determination of minute amounts of arsenic in soils, also matter of animal and vegetable origin.

1. Ber., (1880) p. 1778.
2. Ihid., (1901) p. 33.
3. Ibid., (1910) p. 1218.
4. J. Ind. and Eng. Chem., Vol. 14, p. 207.
5. Ber., (1907) p. 4587.
6. J. Ind. and Eng. Chem., Vol. 10, p. 522.
7. Tech. Methods of Ore Analysis, 8th Ed., p. 35.
8. Eighth Inter. Congress Appl. Chem., (1) 38.

ELECTROLYTIC EXTRACTION OF COD LIVER OIL

A demonstration of the extraction of cod liver oil by means of electrolysis—a method recently introduced by George D. Roger at Massachusetts Technological Institution—was arranged in Bergen for those interested in the cod liver oil trade. The method is described as follows: The raw material, the cod livers, is placed in a tank where an equal quantity of water is already heated to 45° C. Salt is added to provide a suitable electrolytic material. From the first tank the mixture is conveyed into the electrolyser, and a current is passed in order to separate the fat. The material then passes to the settling tank and finally through a separator, which conducts the water into one barrel and the oil into another. The apparatus extracts up to ninety-eight per cent. of fat from the crude material, and, with a consumption of current of five kilowatts, about 1,000 kilos. of oil can be produced per hour, or about eighty barrels daily. The demonstration was not so successful as anticipated, owing chiefly to the fact that the livers used were not quite fresh. The product was liquid on coming heated from the separator, but later it became a solid mass at 15° C. The new method as it stands seems actually of minor importance for the manufacturing of the finest steam-refined medicinal cod liver oil, but some slight modification of the method may yield a satisfactory result. At the present time, however, the process seems to be well adapted for the extraction of industrial oils, such as herring oil, whale oil, etc.

LONGMANS, GREEN & CO. ESTABLISH CANADIAN BRANCH

Longmans, Green & Co. have established a Canadian branch at 210 Victoria St., Toronto. This is a recognition of the development of their book business in Canada. As publishers of technical and industrial books, they have expanded their business very largely during the last few years, and it is now understood that stocks of technical and chemical works will be carried for the first time in Canada. Mr. Pike and Mr. Melvin are in charge of the Canadian branch.

The Ford Motor Car Company of America have purchased a site at Southampton, England, for the erection of a car factory to cost $1,000,000.

The Relation Between Gas Evolved and the Digestion of Sewage in Activated Sludge

By George H. W. Lucas

In the spring of 1921 an attempt was made to determine the relation existing between the composition of the gas evolved and the digestion of the sewage in the activated sludge tanks at the Government Experimental Station, Stanley Park, Toronto.

The percentage of carbon dioxide was relatively small, and in order to measure it accurately eighteen litres of the gas were passed through Baryta water and the CO_2 determined from the amount of barium carbonate precipitated. The oxygen percentage was measured in the ordinary way using alkaline pyrogallol. Nitrogen was estimated by difference since no methane or carbon monoxide were present.

A preliminary investigation on the sludge tank (data in Table 1) indicated that the amount of carbon dioxide and oxygen in the escaping gas was dependent on the quantity of air used as well as on the amount of oxidizable matter present. At any one place in the tank, the percentage of CO_2 and O_2 were fairly constant. In view of the fact that the sewage was not constant either in composition or in flow it was decided to work with an apparatus in which each factor would be under control.

The investigation now fell naturally into two parts:—the activation of sewage of known composition with varying amounts of air, and the activation of a mixture of sewage and sludge in a similar manner. Assuming that the air used in aerating the sewage furnished all the oxygen whereby the nitrogenous and carbonaceous matter is oxidized, it is quite probable that the rate of oxidation is dependent on the volume of air admitted and the amount of oxidizable matter present. It is, also, evident that a state of equilibrium will be reached for the products of the reaction.

As a preliminary experiment it was decided to see if by using a small amount of air, one could arrive at a state of equilibrium and detect it by estimating the nitrates and nitrites together with the CO_2. From the data in Table 2 it is quite plainly observed that equilibrium in the carbonaceous oxidation was reached in three days. The nitrate was very slow in forming, thus giving an indication that carbonaceous oxidation is accomplished more easily than nitrogenous.

The next investigation was conducted on a fresh sample of sewage direct from the sewer, aerating with a larger volume of air. A more complete analysis was made, and from the data in Table 3 it is evident that a state of equilibrium in the nitrate was arrived at in three days. There is also an indication here of a more rapid oxidation in the carbonaceous matter.

It remained to discover the minimum time in which one could reach the equilibrium stage and accordingly a fresh sample of sewage was aerated with a large volume of air. Data in Table 4 furnishes evidence of this stage being reached in forty-eight hours.

Before aerating a sample of sewage which was inoculated with sludge, it was considered expedient to ascertain the effect of the presence of sludge on a sample which had been brought to a state of equilibrium by aeration. A new sample of fresh sewage was aerated similarly to the previous one, and in forty-eight hours the equilibrium state was almost reached. (Data Table 5A). Aeration was continued for six days, and then the tank was inoculated with 14% washed activated sludge. The data in Table 5B leads one to deduce that the effect of adding sludge is almost nil, and therefore the sludge itself was in a state of equilibrium in respect to oxidation by the air when it was introduced.

If this be the case then, the presence of sludge in a sample of sewage should not increase the rate of oxidation. A sample of fresh sewage was inoculated with 17% washed sludge and was aerated similarly as the previous samples were. Data in Table 6 indicates that the presence of this sludge did not hasten

TABLE No. 1
% GASES

Month	Date	Time	% Gas from Activating Tank			From Re-activating Tank			% Gas in Air			Remarks
			CO_2	O_2	N_2	CO_2	O_2	N_2	CO_2	O_2	N_2	
May......	30	Noon 12.00	.97	19.83	79.20	1.49	18.81	79.70	.....	.....	.....	
June......	1	a.m. 10.30	.61	20.29	79.10	1.24	19.66	79.10	.....	.....	.....	Sewage off during night, turned onat 9.00 a.m.
June......	1	p.m. 4.00	.83	20.07	79.10	1.19	19.21	79.60	.....	.....	.....	
June......	2	Noon 12.00	.50	20.40	79.10	1.14	19.06	79.80	.....	.....	.....	Sewage off during night, turned on at 9.20 a.m.

Up till this time, sample of gas in both reactivating and activating tank were taken from third baffle. The collecting apparatus was then shifted to the settling tank, while the apparatus in the reactivating tank was left at the third baffle.

June.......	7	p.m. 1.45	1.75	18.35	79.90	1.16	18.94	79.90	.....	.....	.....	Sewage off for three days.
June.......	8	a.m. 10.00	1.47	18.53	80.00	.65	19.55	79.80	.....	.....	.....	Sewage off during night.
June......	8	p.m. 3.00	2.01	17.36	79.60	1.06	19.04	79.90	.....	.....	.....	Sewage turned on 9.20 a.m.
June ..	9	a.m. 10.30	2.27	17.93	79.80	1.29	18.61	80.10	.....	.....	.....	Sewage turned off during night.
June	9	Noon 12.00	....	.....	.....	....	.....	.....	.27	20.42	79.30	
June	9	p.m. 1.00	1.70	18.60	79.70	1.19	18.81	80.00	.....	.....	.....	

TABLE 2

Day	Month	Date	Time	a.m. p.m.	Temp. Tank	DO₂	% Gases			Nitrate	Nitrite
							CO_2	O_2	N_2		
Thursday...	June	23	9.30	a.m.	16.0	2.8	....	....	....	0	0.25
Thursday...	June	23	2.00	p.m.	22.0	1.9	0.81	19.79	79.4	0	0
Thursday ..	June	23	4.45	p.m.	23.0	0.5	1.23	19.47	79.3	0	0
Friday.....	June	24	9.15	a.m.	23.0	0.3	1.39	18.91	79.7	0	0
Friday.....	June	24	4.45	p.m.	24.0	0.9	1.62	18.82	79.8	0	0
Saturday...	June	25	9.15	a.m.	22.5	3.8	1.19	19.31	79.5	0	0.1
Sunday.....	June	26	10.45	a.m.	23.0	3.7	1.43	18.87	79.7	0	0
Monday....	June	27	9.10	a.m.	24.0	4.0	0.83	19.67	79.5	0	0.2
Monday....	June	27	4.20	p.m.	25.0	4.1	1.04	19.36	79.6	0	0.1
Tuesday....	June	28	9.10	a.m.	24.0	4.2	0.85	19.75	79.4	0	2.8
Tuesday....	June	28	4.45	p.m.	24.0	4.4	0.95	19.75	79.3	0	1.0
Wednesday.	June	29	9.10	a.m.	24.0	4.6	0.67	19.93	79.4	0	0.6
Wednesday.	June	29	4.45	p.m.	24.5	4.7	0.90	19.80	79.3	Trace	Trace
Thursday...	June	30	9.20	a.m.	24.0	4.6	0.76	20.04	79.2	1.0	0
Thursday...	June	30	4.45	p.m.	24.5	4.7	....	.....	79.2	1.50	0
Friday.....	July	1	12.45	Noon	25.5	4.6	1.07	19.69	79.3	3.00	...

TABLE 3

Day	Month	Date	Time	a.m. p.m.	Temp. Tank	D.O.	% Gas			Nitrate	Nitrite	Free NH_3	%Solids in Half Hour Standing		
							CO_2	O_2	N_2				Alb. NH_3	Sample	Color Sewage
Wednesday	July	6	10.00	a.m.	19.0	3.9	0.42	20.48	79.1	0	Trace	11.0	8.2	0.5	Grey
Wednesday	July	6	4.00	p.m.	24.5	4.6	0.91	19.89	79.2	Trace	0.15	2.8	6.8	1.4	Yellow Brown
Thursday..	July	7	9.10	a.m.	25.0	5.5	0.37	20.43	79.2	0.45	0.3	4.4	8.0	2.0	Golden Brown
Thursday..	July	7	3.30	p.m.	26.5	5.2	0.65	20.15	79.2	1.25	Trace	7.0	6.0	2.4	Dark Brown
Friday....	July	8	9.10	a.m.	25.5	5.5	0.26	20.24	79.5	1.75	0	1.2	5.6	2.5	Dark Brown
Friday....	July	8	3.30	p.m.	25.5	5.5	0.53	20.07	79.4	45	0	0.6	6.0	2.5	Dark Brown
Saturday..	July	9	9.05	a.m.	23.5	5.8	0.20	20.70	79.1	2.5	5.0	0.5	4.2	2.5	Dark Brown
Saturday..	July	9	3.30	p.m.	24.5	5.8	0.45	20.35	79.2	5.0	1.0	...	...	2.5	Dark Brown
Sunday....	July	10	9.25	a.m.	....	....	0.29	20.51	79.2	5.0	0.1	...	...	2.5	

Effluent clear and sparkling.

TABLE 4

Day	Month	Date	Time	a.m. p.m.	Temp. Tank	Miller D.O.	% Gas			Nitrate	Nitrite	Free NH_3	Alb. NH_3	P.P.M. Tot. 1cc. of Gas			Dis-solved per litre N_2	Solids Settling in Half Hour	
							CO_2	O_2	N_2					N_2	CO_2	O_2		Hr.	Color
Mon...	July	11	10.00	a.m.	19.0	5.4	0.21	20.59	79.2	.2	0	11.2	13.0	72	8.3	4.5	15.7	½%	Grey
Mon...	July	11	3.30	p.m.	23.0	5.5	0.54	20.36	79.1	0.2	0.2	11.5	11.5	69	15.4	4.6	18.0	2%	L. Brown
Tues...	July	12	9.10	a.m.	24.5	9.6	0.38	20.32	79.3	5	1.5	3.0	11.5	56	4.0	3.0	14.4	2.5%	L. Brown
Tues...	July	12	3.30	p.m.	26.0	5.4	0.48	20.42	79.1	8	0.1	3.0	13.5	51	4.0	4.5	13.7	3%	L. Brown
Wed...	July	13	9.10	a.m.	25.0	5.5	0.32	20.38	79.3	15	1.0	6.5	3.5	51	4.4	5.5	13.9	3.5%	L. Brown
Wed...	July	13	3.30	p.m.	26.5	5.5	0.25	20.65	79.1	16	2.5	2.3	11.8	51	0.5	5.3	13.6	3.5%	D. Brown
Thurs..	July	14	9.10	a.m.	26.0	5.7	0.23	20.37	79.4	14	0.5	3.1	6.7	51	22	6.0	14.2	3.5%	D. Brown
Thurs..	July	14	3.30	p.m.	26.5	5.7	0.12	20.78	79.1	15	1.8	4.0	6.4	52	2.7	6.0	14.2	3.5%	D. Brown
Fri.....	July	15	9.10	a.m.	25.0	5.8	0.12	20.58	79.3	15	0.12	2.2	7.2	80	3.1	6.1	14.0	4%	D. Brown
Fri.....	July	15	3.30	p.m.	25.0	5.8	0.18	20.72	79.1	16	0.2	1.6	6.3	51	4.3	6.1	14.4	4%	D. Brown
Sat....	July	16	9.10	a.m.	23.5	6.0	Lost	.....	79.4	15	.05	1.6	12.0	51	1.8	6.1	14.1	4%	D. Brown
Mon...	July	18	9.10	a.m.	24.0	6.0	0.36	20.04	79.6	15	Trace	6.5	18.0	50	1.7	6.1	13.8	4%	D. Brown
Mon...	July	18	3.30	p.m.	....	...	....	.....	....	..	Trace	1.5	8.0	50	...	...	....	....	

the oxidation for this sample behaved in no wise differently than a sample of sewage alone.

The accompanying graph will help the reader to see more quickly that the presence of sludge did not hasten the formation of nitrates. The amount of solids present in the raw sewage no doubt has some effect, and possibly accounts for the more rapid rate in the case of Table 4.

The reader's attention will no doubt be drawn to the peculiar fluctuation in CO_2. This was due to the varying amounts of CO_2 in the air at the plant. In Table 6 the net CO_2 shows a steady decrease till a fairly constant state is reached.

From the experimental data submitted, it may be said in conclusion that the carbonaceous matter is apparently oxidized more easily than the nitrogenous. The variation of percentage

TABLE 5A

Day	Montb	Date	Time	a.m. p.m.	Tank Temp.	Miller D.O.	Agitating Gas CO_2	Agitating Gas O_2	Agitating Gas N_2	P.P.M. Nitrate	P.P.M. Nitrite	Free NH_3	Alb. NH_3	Total Nitrogen in sample	Total Nitrogen in effluent	Total Solids in 100cc sample	Total Solids in 100cc effluent	Dissolved Gas per Litre CO_2	Dissolved Gas per Litre O_2	Dissolved Gas per Litre N_2	Amt. Solids ½ Hr.	Color Solids
Wed..	July	20	3.15	p.m.	18.5	6.0	0.33	20.47	79.2	1.2	0.75	7.0	8 0	76	65	0.112	0.060	14.6	4.8	15.8	1%	Gray
Wed..	July	20	3.30	p.m.	22.0	5.9	0.31	20.69	79 0	1.2	0.8	7.0	6.0	57	43	.....	.....	16.4	5.3	15.3	1%	Gray
Thur..	July	21	9.10	a.m.	22.0	5.7	0.33	20.07	79 6	3.0	1.0	7.0	6.0	40	37	0 077	0.057	13.7	5.1	14.8	1%	Slightly brown
Thur..	July	21	3.30	p.m.	23.5	6.2	0.29	20.51	79.2	4.4	0 5	7.5	7.0	38	35	.....	. .	6.5	6.0	14.5	1.2%	Yellow brown
Fri...	July	22	9.10	a.m.	23.0	6.1	0.36	20.04	79.6	10	Trace	3 5	5.0	34	29	0.071	0 048	4.8	6.4	14.6	1.2%	Yellow brown
Fri...	July	22	3.30	p.m.	24.0	6.1	0 36	20.64	79.0	10	0.4	3.5	6 0	31	21	.....	. . . .	3.9	6.3	14 3	1.2%	Yellow brown
Sat...	July	23	9.10	a.m.	23.0	6.3	0.15	20.35	79.5	12	1.0	1.5	4 5	28	22	0 076	0 057	3.6	6.5	14.3	1.3%	Yellow brown
Mon..	July	25	9.10	a.m.	24 0	6.3	0.20	20.59	79.2	10	0.2	1.0	4.5	28	23	0 052	0 062	1 6	6.3	14 1	1.4%	Yellow brown
Mon..	July	25	3.30	p.m.	25.5	6.4	0.21	20.56	79 2	13	0.2	2.0	4.5	..	..	.		3.1	6.9	15.6	1.5%	Yellow brown
Tues..	July	26	9.10	a.m.	24.5	6 4	0.23	20 33	79 4	12	0.2	2.0	4.5	27	23	.	.	7 5	6.3	13.9	1.5%	Yellow brown

TABLLE 5B

INOCULATED WITH 14% SLUDGE

Day	Month	Date	Time	a.m. p.m.	Tank Temp.	Miller D.O	Agitating Gas CO_2	Agitating Gas O_2	Agitating Gas N_2	P.P.M. Nitrate	P.P.M. Nitrite	Free NH_3	Alb. NH_3	Total Nitrogen in sample	Total Nitrogen in Effluent	Total Solids in 100cc sample	Total Solids in 100cc Effluent	Dissolved Gas per Litre CO_2	Dissolved Gas per Litre O_2	Dissolved Gas per Litre N_2	Amt. Solids in ½ hour	Color Solids
Tues..	July	26	2.00	p.m.	25.5	6 4	....	.....	79.2	12	0.5	3.0	60	153.5	22	0.249	.050	0.6	5.6	13.8	15%	Greyish black
Tues..	July	26	3.30	p.m.	26	6 4	0.41	20.09	79.5	15	0.9	7.5	79	140	31	.....	. . . .	2 5	6.0	13.5	15%	Greyish black
Wed..	July	27	9.10	a.m.	26	6.3	0.34	20 26	79 4	16	1.7	2.4	66	128	29	0.233	.053	Bro	ke		14%	Tinge of brown
Wed..	July	27	3.30	p.m.	26 5	6.3	0.48	20.12	79.4	16	1.75	5.8	91	143	31	. . .	.	Ap	para	tus	14%	Tinge uf brown
Thur..	July	28	9.15	a.m.	25.5	6.3	0.38	20.42	79.8	17	0.75	2.4	80	134	27	0 233	.058	2.6	6.1	13.8	14%	Little browner
Thur..	July	28	3.30	p.m.	26	6.2	0.42	20.18	79.4	16	0.60	2.6	66	127	31	. . .		1.8	6 0	14.0	14%	Brownish
Fri...	July	29	9 10	a.m.	24.5	6.1	. .	.....	79.5	17	0.35	1.4	59.5	126	31	.....	. .	2.3	6.2	14.2	14%	Dark brown
Fri...	Julv	29	3.30	o.m.	25	6.1	0 34	20.46	79 2	18	0.15	2 0	58.4	. .	. .	. . .		0.2	6 1	14 1	14%	Dark brown

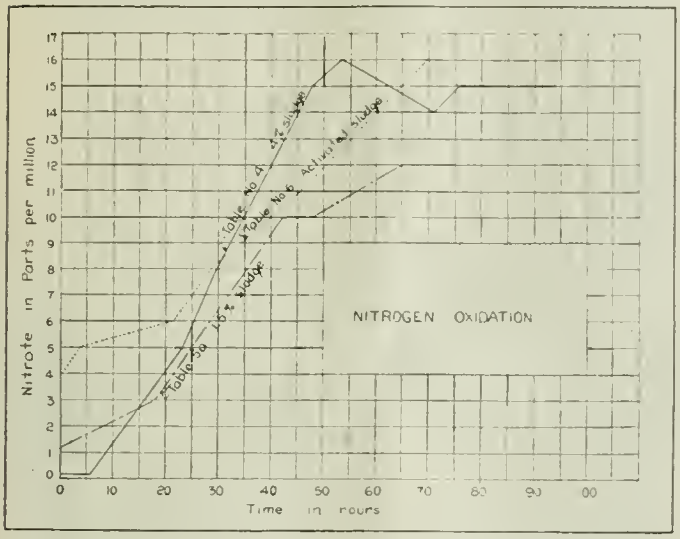
Total Nitrogen in Sample 5.6. Total Nitrogen in Effluent 5.1.

TABLE 6

Day	Month	Date	Time	a.m. p.m.	Temp Tank C.	Miller D.O.	Percentage of Gas in Ag. CO_2	Percentage of Gas in Ag. O_2	Percentage of Gas in Ag. N_2	Percentage in Air CO_2	Percentage in Air O_2	Percentage in Air N_2	Net CO_2	Nitrate	Nitrite	Free NH_3	Alb. NH_3	Total Nitrogen in Sample	Total Nitrogen in Effluent	Total Solids in Sample	Total Solids in Effluent	C.C. per Litre Dissolved Gases CO_2	C.C. per Litre Dissolved Gases O_2	C.C. per Litre Dissolved Gases N_2	Amt. of Flock in ½ hr.	Color of Flock
Thur.	Aug.	4	11.50	a m.	20	2 2	.90	19.70	79.4	.20	20.70	79.1	.70	4	.02	6.0	38.0	186	66	....	....	Broke	Appar	atus	17%	Grey black
Tbur.	Aug.	4	3.30	p.m.	21	5.2	.63	20.17	79.2	.18	20.92	78.9	.45	5	0.25	4.5	40.0	221	25	.401	.050	3.2	4 4	16.8	16%	Grey black
Fri...	Aug.	5	9.30	a.m.	21	5.3	.49	5.21	79.3	.20	20.60	79.2	.29	6	0.05	5.0	57.0	186	18	.349	.045	4.0	5.0	15.4	16%	Grey black
Fri...	Aug.	5	3.20	p.m.	24	5 5	.49	20.11	79.4	.23	20.67	79.1	.26	8	0.12	8.0	84.0	204	.	.225	....	2 9	5.5	15.2	17%	Grey black
Sat..	Aug.	6	9.30	a.m.	23	5.4	.40	20.30	79 3	.13	20 33	79.4	.27	11	0.2	3.7	58.0	194	20	....	.050	1.2	5.4	14.6	17%	Slightly brown
Mon.	Aug.	8	9.30	a.m.	21	5.6	.28	20.42	79.3	.14	20.56	79.3	.14	16	Trace	2.2	65.0	169	25	.332	056	3.7	6 0	14.6	....	
Mon.	Aug.	8	3.30	p.m.	23	5.7	.18	20.72	79.1	.14	20.76	79.1	.04	15	Trace	4.2	34.0	188	16	....	....	3.7	6.0	14.3	17%	Slightly brown
Tue..	Aug.	9	9.30	a.m.	21	5.8	.23	20 67	79.1	12	20.69	79.2	.11	15	0.05	3.7	38.5	169	15	.348	.058	2.5	6 0	14 4	16%	Slightly brown
Tue..	Aug.	9	3.30	p.m.	23.5	5.9	.24	20.76	79 0	.17	20.73	79.1	.07	15	0.2	5.5	45 0	...	19	....	....	0.2	6.0	13.6	16%	Becoming browner
Wed.	Aug.	10	9.30	a.m.	21	5.8	.24	20.56	79.2	.18	20.62	79.2	.06	15	.75	5.4	46.0	176	18	.360	.065	0.1	5.8	13 6	16%	Darker brown
Wed.	Aug.	10	3.30	p.m.	23	5.8	.26	20.64	79.1	.14	20.76	79.1	.12	16	Trace	4 8	55.0	190	16	....	. . .	3 5	5.9	13.8	17%	Darker brown
Thur.	Aug.	11	9.20	a.m.	21	5.7	.26	20.56	79 2	.19	20.71	79.1	.07	15	Trace	3.7	56.0	157	19	....	....	3.6	6.1	14.1	17%	Darker brown
Tbur.	Aug.	11	3.30	p.m.	22	5.8	...	.....	....	...	.....	....	....	15	Trace	6.5	67.0	...	..	....	....	1.4	6.2	14.0	17%	Darker brown

Total Nitrogen in the sample is 5.6%. Total Nitrogen in the Effluent is 4%.

of CO_2 and O_2 in the air before passing into the sewage, and after is relatively small, and becomes smaller as the volume of air is increased. The nitrogen undergoes but little change.



Graph Illustrating Formation of Nitrates.

More important, however, is the fact that the presence of activated sludge, while it may aid in clarification does not accelerate oxidation of raw sewage. Finally it is interesting to note that the estimation of dissolved oxygen by Miller's method checks closely with the result obtained when the gas was boiled out, and estimated in a Hempel Gas Burette.

My thanks are due Mr. A. V. Delaporte, chemist in charge of the Experimental Station, and Mr. F. A. Dallyn, head of the Sanitary Engineering Division, Toronto, who supervised this research.

PETROLEUM PRODUCTION IN THE UNITED STATES

The production of petroleum in the United States in 1921, as indicated by the quantity transported from producing properties, compiled from company reports to the United States Geological Survey, amounted to 469,639,000 barrels, representing an estimated value at the wells of $753,300,000. These figures will be increased somewhat by the quantity of petroleum consumed for fuel on the leases and by the net change in storage held on producing properties at the beginning and end of the year, when results of a canvass of the many thousand producers become available. This is the greatest quantity ever produced in the United States in any one year, and represents an increase of 26,237,000 barrels over the production of 1920, and is more than double the quantity produced in the United States in 1912.

World's production figures for 1921 are not yet known, but preliminary estimates indicate a total not far from 750 million barrels, as compared with 695 million barrels produced in 1920.

Imports of crude oil into the United States during 1921 amounted to 125,307,000 barrels, compared with 106,175,000 barrels in 1920 and 52,822,000 barrels in 1919, these figures corresponding respectively to 27, 24, and 14 per cent. of the domestic production of the past three years. Exports of crude oil during 1921 amounted to 8,940,000 barrels, and during 1920 to 8,757,000 barrels.

Estimated consumption (deliveries to consumers) of domestic and imported crude oil during 1921 amounted to 525,407,000 barrels, as contrasted with 530,474,000 barrels in 1920. Consumption for the year just ended therefore amounted to 55,768,000 barrels more than the country produced.

THE ACTION OF SEVERAL SALT SOLUTIONS ON ALUMINIUM, COPPER, LEAD AND ZINC

By Cyril H. Crowe

The object of the investigation was to determine the action of several salts of each of the three acids, hydrochloric, sulphuric, and nitric on the four metals, aluminium, copper, lead and zinc.

In each case, 300 cc. of a normal solution of the salt was put in a one litre round bottomed flask, with the metal, and was gently boiled for six hours each day, a reflux condenser being used to prevent loss of water. The metal was weighed before and after boiling, and the change in weight noted.

The metals were introduced in the form of strips, the total surface of each metal being about 2 sq. dm.

Before immersing in the solution, each strip was sandpapered so as to ensure a clean, bright surface, and then, with the exception of the lead, was carefully washed in water, dried and weighed. The lead was not washed, because it was found that the surface was thereby tarnished before it had been immersed in the salt solution.

Distilled water was used throughout the experiment.

The salts used were (a) commercial sodium chloride, it having been found that the action was the same as with the C.P. salt; (b) potassium sulphate C.P.; (c) sodium nitrate C.P., and (d) potassium nitrate C.P.

In order to determine what part of the action was due to the presence of the salts, a set of blanks was run through in which the metals were boiled in distilled water in a similar manner to the boiling with the salt solutions.

A check on any change in the solutions as regards acidity or alkalinity was kept by titrating the solutions with alkali or acid before and after boiling.

Note was also made of the appearance of the surface of the metals after boiling, and any residues that were deposited.

The results of the boilings are noted in the various tables following:—

TABLE 1

ALUMINIUM

Salt	Change in Wt. Sq. Dm. of Surface after boiling 24 Hours	Acidity or Alkalinity after Boiling	Appearance of Metal after Boiling	Appearance of Residue
Water...	Gain .0170g.	Neutral	Dull	None
NaCl....	Gain .0155	Neutral	Dull coating	Slight residue
K_2SO_4 ..	Gain .0055	Slightly Alkaline	Unchanged	Trace
$NaNO_3$..	Gain .0130	Neutral	Unchanged	None
KNO_3...	Gain .0105	Neutral	Unchanged	Trace

A comparison of the above results shows that the presence of the salt in each case does not have any marked effect on the aluminium which would not have been due to the water itself. The metal used was a sample obtained from J. T. Baker and Co.

TABLE 2

COPPER

Salt	Change in Wt. Sq. Dm. of Surface after Boiling 24 Hours	Acidity or Alkalinity after Boiling	Appearance of Metal after Boiling	Appearance of Residue
Water...	Loss .0005g.	Neutral	Dull	None
NaCl....	Loss .0155	Neutral	Slightly Tarnished	Fine Green Precipitate
$MgCl_2$...	Loss .0090	Neutral	Bright and Clean	Fine Green Precipitate
K_2SO_4...	Loss .0065	Neutral	Badly Tarnished	None
$MgSO_4$...	Gain .0010	Neutral	Discolored	None
$NaNO_3$..	.0000	Neutral	Discolored	None
KNO_3...	.0000	Neutral	Discolored	None
$Mg(O3)_2$	Gain .0025	Neutral	Discolored	None
$Zn(NO_3)_2$	Loss .0020	?	Discolored	None

A comparison of the above results shows that chlorides and sulphates have an appreciable action on copper, while nitrates do not noticeably affect it, except to discolor the metal. It is worthy of note that traces of copper were detected in the sulphate solutions after the boilings. The sample of metal used was pure copper foil.

TABLE 3
LEAD

Salt	Change in Wt. Sq. Dm. of Surface after boiling 24 Hours	Acidity or Alkalinity after Boiling	Appearance of Metal after Boiling	Appearance of Residue
Water...	Loss .0800g.	Alkaline	Dull	Fine White Precipitate
NaCl....	Gain .0120	Alkaline	Dull Coating,	Fine White Precipitate
K_2SO_4...	Gain .0335	Alkaline	Dull, Coating	None
$NaNO_3$..	Loss .1420	Alkaline	White Coating	Fine White Precipitate
KNO_3...	Loss .0760	Alkaline	White Coating	Fine White Precipitate

The sample of metal used was a commercial specimen. As one would expect, the lead was attacked to a considerable extent by all the solutions, especially the nitrates. The latter were quite destructive to the metal. A considerable amount of residue was deposited, and the solution became distinctly alkaline. In the case of the chlorides and sulphates, a coating prevented continuous action.

TABLE 4
ZINC

Salt	Change in Wt. Sq. Dm. of Surface after boiling 24 Hours	Acidity or Alkalinity after Boiling	Appearance of Metal After Boiling	Appearance of Residue
Water...	Gain .0175g.	Neutral	Dull	White residue
NaCl....	Gain .0025	Neutral	Dull, coating	White residue
Na_2SO_4..	Loss .0085	Alkaline	Dull	White residue
K_2SO_4...	Loss .2000	Alkaline	Dull, coating	White residue
$MgSO_4$...	Gain .0950	Alkaline	Dull	White residue
$NaNO_3$..	Loss .0100	Alkaline	Dull	White residue
KNO_3...	Loss .0980	Alkaline	Dull	White residue

As the above table shows, zinc is attacked to a considerable extent by the sulphates and nitrates, and is very little attacked by the chloride.

An attempt was made to see whether the hydrogen ion concentration played any part in the re-action, by repeating several of the boilings, having present a "buffer" solution which would tend to prevent the hydrogen ion concentration from changing. The "buffer" solutions used were a mixture of the two salts, sodium di hydrogen phosphate and di sodium hydrogen phosphate, and sodium acetate and boric acid. The amount of attack on the metals was practically the same as with the "buffer" solutions absent.

The residues deposited were of a basic nature.

SUMMARY

A consideration of the results in the various Tables shows that:

1. (1) All four metals are attacked by boiling, distilled water in presence of air, in varying degrees.
2. (2) Aluminium is not attacked to any great extent by any of the salts used.
3. (3) Copper is impervious to the action of nitrates, but is attacked to a certain extent by the chloride and sulphates.
4. (4) The action of all the salts used on lead is very noticeable, especially the nitrates.
5. (5) Sulphates and nitrates attack zinc to a considerable extent, while chlorides have very little effect.
6. (6) The action of the various salts on the four metals is not due to the solutions being slightly acid or alkaline.

Department of Chemistry,
Queen's University,
Kingston, May 20, 1922.

WELLAND, ONT.—The Volta Manufacturing Co., Ltd., have received an order from Reuton & Fisher, Ltd., of the Hoptown Steel Works, Bathgate, Scotland, for a three-ton standard electric steel furnace, complete with transformer and switchboard equipment.

NEW EDITION OF "AMERICAN RESEARCH CHEMICALS"

The compilation of research chemicals which was prepared by Clarence J. West for the Committee on Research Chemicals of the American Chemical Society and the Research Information Service of the National Research Council has just been issued in revised form as Number 35 of the "Reprint and Circular Series" of the National Research Council. The marked advance shown by the American chemical industry during the last few years is evidenced by the surprisingly large number of high grade chemicals listed in this publication as now purchasable from American manufacturers. The so-called "heavy chemicals" have been omitted because there are so many recognized manufacturers and dealers from whom they may be secured. For the same reason practically all inorganic salts are omitted.

Nearly three hundred research chemicals, not included in the first edition, have been added in this revised list. Many additions have also been made to the list of biological stains and indicators, while a list of dyes that have been carefully purified for use as vital stains has been added. The list of hydrogen ion indicators has been very much extended and a chart of these, showing the hydrogen ion concentration range added.

It is recognized that the list may have shortcomings and constructive criticisms and additions will be welcomed. Those interested in this booklet may secure a copy from the Research Information Service, National Research Council, Washington, D.C.

NEW PROCESS FOR "CRACKING" HEAVY CRUDE OILS IS STILL IN EXPERIMENTAL STAGE

Because of certain unauthorized and rather extravagant statements that have recently appeared in the press concerning the so-called Bowie-Gavin "cracking" process, the United States Bureau of Mines has thought it best to make an official statement outlining the true situation regarding the experimental work that has been done up to the present time.

The process is designed primarily for the cracking of tars, heavy crudes, residuals, etc. It is possible that it also may be applicable to the recovery of oils from oil-soaked sands, oil-shales, etc., but no attempt has been made to perfect it along these lines, as it is not felt that extractions of this nature could be made profitably under present commercial conditions.

The process consists briefly of cracking hydrocarbon materials that contain no gasoline or kerosene products, in a still of novel design, and producing a cracked oil yielding relatively large proportions of gasoline, kerosene, etc. It is designed to be continuous and the recovery of cracked oil is often as much as 85 per cent. by volume of the original oil used. The oil produced by the process contains a relatively high percentage of unsaturated products. Results to date have indicated that many of the carbon difficulties,—always a bugbear in cracking heavy oils—have been overcome. An attempt is being made to convert the carbon into producer gas, which, together with the fixed gas yielded in every cracking process will furnish a considerable portion of the fuel necessary for operating the plant.

Laboratory experiments have been carried on by the Bureau of Mines for a number of years, and within the past year, an eight-foot commercial apparatus has been constructed and operated intermittently at San Francisco. No claims have ever been made that the process has reached a commercial success; on the contrary, it is still decidedly in the experimental stage. However, tests recently made indicate that, so far as the still is concerned, the remaining mechanical difficulties could possibly be overcome by continuous operation of the plant. As this will probably require a larger amount of money than the Bureau of Mines will be able to expend, it is doubtful whether the bureau will be able to carry the experiments to a satisfactory conclusion.

A bulletin covering the process and apparatus is being prepared.

Iron and Steel: a Great Maritime Province Industry

The Development of the Industry Outlined and Plants Described

By W. F. Ingalls

THE essential requirements of the iron and steel industry, iron ore, coal and fluxing materials, are found in abundance in the Maritime Provinces. Hence it is not surprising that the industrial wealth of this part of Canada comes largely from the manufacture of iron and steel. The development of the industry has been gradual and not unaccompanied by some disappointments and failures; but the record of the past hundred years, which covers the history of this enterprise, shows that the early manufacturers were justified in their faith.

Nova Scotia has numerous deposits of iron ores of limited extent, some of which are of considerable value, but profitable only as they complement other sources of ore supply. There are deposits in Annapolis County on the south shore of the Bay of Fundy, particularly important ones being found at Nictaux Falls. In Colchester and Cumberland Counties siderite and ankerite occur in close proximity to coal and fluxing material. In Pictou County there is ore of a very high grade, but mining operations are too expensive to compete against Newfoundland ores. At the present time most of the ores used in the manufacture of iron in the Maritime Provinces are imported from the Wabana Mine in Newfoundland.

In the other necessary materials Nova Scotia is well favored. There is plenty of limestone for flux in various parts of the Province and there are several important coal fields. The most important is the Sydney Coalfield in Cape Breton which produces an excellent coking coal very suitable for smelting purposes. In Inverness County there are other coal-beds which like those at Sydney, extend under the sea. Pictou County contains a coal deposit covering about fifty square miles and yielding a suitable grade of coal. Another important field is in Cumberland County.

In New Brunswick several deposits of iron ore have been discovered, but the majority are as yet of little economic importance. One large mine near Bathurst was successfully operated but is not now being worked. As New Brunswick has not the coal resources of her sister province the iron and steel industry is not so important as in Nova Scotia.

History of the Industry

Although recent years have witnessed the greatest development of the Canadian iron and steel industries, their history dates back to the French occupation of Canada. The earliest recorded discovery of iron ore was in 1667 near Three Rivers, Quebec. Although Frontenac recommended the establishment of forges and a foundry there, nothing was done until 1730, when Louis XV authorized the working of the ores and advanced 10,000 livres towards the erection of a furnace. The original license holder surrendered his rights to the Crown five years later, and in 1736 La Compagnie des Forges was empowered to erect ironworks and a furnace. Through lack of capital this company gave up, and from 1743 until the British conquest of Canada the St. Maurice Forges were operated by the Crown.

After 1760 the forges passed through the hands of various lessees and owners and were not abandoned finally until 1883. There were several other attempts made to smelt iron in different parts of Quebec, but for one reason or another they were all unsuccessful up to the time of Confederation.

In Ontario also the early history of the iron industry is a record of brave attempts ending in disaster. There were many attempts made during the period from 1800 to 1879, the counties of Norfolk and Hastings being the scenes of several of them; but none of them was able to command success, and in the year 1879 there was no plant in Ontario in operation.

In the Maritime Provinces the year 1825 marks the beginning of the iron industry. In that year the Annapolis Mining Company was formed, with a capital of £100,000, to manufacture iron at Clementsport, Annapolis County. Two bounties of £600 each were given by the Government for the manufacture of a certain quantity of pots, kettles and bar iron. The company built a smelting furnace, coal houses and stores at a cost of £30,000. Charcoal was used for fuel, as a large forest in the vicinity yielded a cheap and plentiful supply. Although the iron produced was of good quality, English competition was too strong, and the works were closed after a short period of operation. They were re-opened for a short time in 1861 and again in 1872 and 1873. In 1874 they passed into the hands of the New York-Nova Scotia Iron and Coal Mining Company and since that date no iron has been produced in that part of the country.

A 4,000-TON FORGING PRESS
Pounding out an Intermediate Line Shaft at Nova Scotia Steel and Coal Company's Works, New Glasgow, N.S.

Stellarton, Pictou County, was the scene of another early attempt at iron making. The General Mining Association opened coal mines there in 1827 and built a foundry and furnace in 1829. W. J. A. Donald in his "Canadian Iron and Steel Industry," describes this attempt. "The furnace-man in charge," he writes, "was an Irishman experienced in the trade, brought over from Great Britain, but he had great difficulty in getting the metal to flow. Although eight tons of iron were made daily, an excess of phosphorus and lack of silicon made it hard and useless for foundry purposes. After fifty tons had been made, the men got drunk one night and left the furnace to take care of itself, which it did for all time to come. In the morning the furnace was cold and the metal a solid mass."

In New Brunswick in 1848 the York and Carleton Mining Company were given 10,000 acres of land by the Provincial Government and spent $30,000 on a blast furnace to smelt ores from a mine which had been discovered at Woodstock twelve years earlier. Misfortune attended this enterprise. After a couple of years' operation the works were damaged by fire and after they had been repaired the plant was wrecked by an explosion. The works were rebuilt by an English firm who manufactured 1,000 tons of iron during the eighteen months in which they operated. The Woodstock Charcoal Iron Company acquired the plant in 1862, but though the iron made was of good quality, the cost of production was too high, and the works were soon abandoned.

The most ambitious of the early manufacturers was the Steel Company of Canada (which must not be confused with the present company of the same name). This company was formed in 1873 to purchase the mines and ironworks at Londonderry and Acadia, Nova Scotia. Dr. Siemens was chairman of the company, and he proposed to use his open-hearth process for the manufacture of steel. The large sum of $2,500,000 was expended in building modern rotatory furnaces, a melting furnace with regenerative gas-furnaces and houses for workmen. Ten miles of railway were constructed between the mines and the plant, and the company also acquired the right to use the lines of the Intercolonial Railway.

Dr. Siemens made his first commercial experiment with the open-hearth process in 1874, but it was a failure. In 1876 and 1877, coke ovens were built, and the first coke blast-furnace erected. The old furnaces and the steel plant were razed, and a rolling mill built on their site. In 1883, the Steel Company of Canada went into liquidation, thus putting an end to the most pretentious endeavor to establish a Maritime iron and steel industry that had been launched up to that date.

About the time when the Steel Company was embarking on its grandiose schemes, another company, starting in a small way, was laying the foundations of a great success. This was the Nova Scotia Forge Company, incorporated in 1874 to continue the operation of a New Glasgow plant opened two years earlier by Graham Fraser for the manufacture of railway and marine forgings. In 1878 the plant was moved to Trenton. In 1882 the management formed the Nova Scotia Steel Company to manufacture steel by the Siemens-Martin open-hearth process, and cast the first steel ingots in 1883. As the original company was the chief customer of the new concern, which in its turn was dependent on the forge for repairs and machine work, an amalgamation was made in 1892, under the name of the Nova Scotia Steel & Forge Company.

In 1888 the New Glasgow Coal, Iron and Railway Company was formed to build a blast furnace at Ferrona (North New Glasgow). Construction started in 1891 and manufacturing operations in the following year. This company in 1894 acquired the Wabana Mine on Bell Island, Newfoundland, as the proportion of manganese in the ores around New Glasgow made them suitable for the manufacture of foundry pig-iron. In 1895 this company was amalgamated with the Nova Scotia Steel and Forge Company under the name of the Nova Scotia Steel Company. In 1901 the Nova Scotia Steel and Coal Company was formed to unite the Nova Scotia Steel Company and the General Mining Association, which was one of the pioneers in the industry. The Eastern Car Company was added to the amalgamated concerns in 1912.

Dominion Steel Corporation

The history of the Dominion Steel Corporation, which was formed by an amalgamation of the Dominion Iron and Steel Company and the Dominion Coal Company in 1909, must also be studied in a view of the Nova Scotian iron and steel industry. The former company was formed by Henry M. Whitney, a Boston capitalist, in 1899. Mr. Whitney was largely interested in the Dominion Coal Company, which was dependent on the United States market for the disposal of the greater part of its product. As this market was uncertain and the closing of St. Lawrence navigation in winter rendered a Canadian market impracticable, Mr. Whitney decided to establish large iron and steel works at Sydney. The Dominion Iron and Steel Company bought the Wabana mines from the Nova Scotia Steel Company for $1,000,000. The company had a spectacular career in its early days, and had to encounter many financial difficulties. Wages and salaries had to be reduced to carry out necessary extensions and a long strike in protest cost the company about $500,000. In 1904 a wire-rod mill was put into operation, and by the following year was supplying 85 per cent. of the iron rods used in Canada. During the depression of 1907 and 1908, the company maintained its volume of business with steady employment and no decrease of wages. By 1909 the financial difficulties were straightened out and the company had a cash reserve. Since the amalgamation, which took place in the same year, industrial and financial operations have proceeded smoothly.

The latest great development in the Nova Scotian steel and iron industry is the formation of the British Empire Steel Corporation, which received its charter in 1920 with an authorized capital of $500,000,000. This is a merger of the Dominion Steel Corporation, the Nova Scotia Steel and Coal Company and the Halifax Shipyards. Its effect is to centralize the control of all the large profitable coal areas of Nova Scotia, the iron ore deposits of Wabana and an adequate number of limestone quarries under one management. The corporation has approximately 37 collieries with a combined yearly output of 6½ million tons, or 93 per cent. of the output of the whole Province. The iron deposits of Wabana are practically inexhaustible. The Halifax Shipyards, located at one of Canada's most important ports, is an important user of steel products, and heavy marine forgings, which the steel subsidiaries in the merger are equipped to provide.

The iron and steel plants which come under the control of the British Empire Steel Corporation through the Dominion Iron and Steel Company consist of the following principal units at Sydney:—Six blast furnaces, with a combined capacity of 1,600 tons of pig iron daily; ten 50-ton open-hearth steel furnaces; two 500-ton active open-hearth mixers; two 15-ton Bessemer converters for use in connection with open-hearth furnaces on duplex system; two hundred Otto Hoffman, 120 Improved Otto, 120 Koppers coke-ovens and 60 additional Koppers ovens under construction, all equipped for recovery of by-products, including tar, sulphate of ammonia, benzol toluol and other oils; sulphuric acid works; 35-inch blooming mill; 28-inch rail mill; Morgan semi-continuous bar and rod mill; wire drawing and nail-mills; 16-inch merchant bar-mill; 110-inch plate mill, the largest in Canada.

There are also included in the properties a Baum coal washery; electric power-plants; piers for discharge of ore and limestone, and for unloading iron, steel and other products; standard and narrow-gauge railroads, connecting all parts of the works with the main lines of the Canadian National Railway system and fully equipped with locomotives and rolling stock; an extensive system of water supply, including practically inexhaustible reservoirs; iron, brass and steel shops, foundries and forges sufficient for the maintenance and repair of all the company's works; plants for the manufacture of silica and clay bricks and slag cement; warehouses, offices and workmen's and officials' dwellings.

The ore properties on Bell Island, Newfoundland, owned by this company adjoin those of the Nova Scotia Steel and Coal Company, so that the Corporation controls the whole of the proved ore in the Bell Island deposit. The quantity of ore recoverable from this source is estimated at between 4,000,000,000 and 6,000,000,000 tons. It is the most important iron ore reserve in the North Temperate Zone.

The Dominion Iron and Steel Company also owns limestone quarries at Marble Mountain, Inverness County, Nova Scotia,

CHARACTERISTIC SCENES IN DOMINION IRON AND STEEL COMPANY'S PLANT AT SYDNEY.

On the left: Charging hot metal into 50-ton open hearth furnace by means of charging machine. On the right: Pouring 50-ton heat

and at Port au Port, Newfoundland, capable of producing and shipping 3,500 tons of limestone daily.

Plants at Sydney Mines

The iron and steel works of the Nova Scotia Steel and Coal Company at Sydney Mines comprise 150 coke ovens; 2 blast furnaces with stoves and other equipment sufficient for continuous operation of one furnace producing 300 tons of pig iron a day; five 50-ton open-hearth furnaces with mixer, stripper, and all necessary accessory equipment to produce 600 tons of ingots a day; Harmet fluid-compression plant for production of compressed ingots up to 30 tons each; electric and steam power plant; workmen's dwellings and general store. Limestone and dolomite quarries at Point Edward and George River in Cape Breton afford an ample supply of fluxing materials.

There is also a manufacturing plant at Trenton, the works of which cover an area of 72 acres, directly adjoining the town of New Glasgow and served by the Canadian National Railway. The buildings thereon, numbering thirty in all, house a complete equipment for cogging ingots to blooms and billets, and carrying them to finished materials in the form of forgings, car and locomotive axles, polished shafting and bars, industrial rails up to 45 pounds a yard, plates, railway fish-plates, structural steel shapes, angles, etc. These works are equipped with facilities for the production of all necessary steam and electric power and have a warehouse, storage yards and ships. They give employment to about 1,100 men. Their daily capacity is as follows:—Rolled bars, rails, plates, etc., 300 tons; forgings, 50 tons; car and locomotive axles, 70 tons; railway spikes, 50 tons; track bolts and nuts, 30 tons.

A Big Car Plant

The property of the Eastern Car Company, a subsidiary of the Nova Scotia Steel and Coal Company, adjoins that of the latter firm at Trenton. The plant consists of a main car shop, 1,100 feet long and a car wheel foundry, power house, dry kiln, store houses, locomotive houses and general office. The main buildings are of steel and concrete construction, well lighted and ventilated. There is a complete mechanical equipment for turning out steel, wooden and composite cars. Crane runways which extend over the entire length of the main buildings carry seven overhead electric cranes. Most of the machines are electrically driven, and the boiler house is equipped with automatic stokers. There is a large storage yard for lumber and steel served by overhead cranes.

The present capacity of the plant is 25 steel-frame box cars a day, and this can be doubled with a little expenditure. The wheel foundry has capacity for an output of 200 wheels a day with provision for double that number. From 600 to 1,200 men are employed and the annual payroll varies from $300,000 to $500,000.

The iron and steel industry of Nova Scotia as now concentrated under the management of the British Empire Steel Corporation is unique in Canada as being the only thoroughly self-contained and completely integrated industry of its kind in the country.

The Corporation owns and mines coal and iron ore from properties sufficiently large to enable production to be carried on for centuries. All necessary raw materials are situated in Nova Scotia or Newfoundland, the activities of the corporation therefore being entirely British both as to origin of raw materials and place of manufacture.

Not only does the Corporation own all the raw materials required, but it possesses freight fleets, railways and terminal facilities at various points in Nova Scotia and Eastern Canada of a very complete character, making transportation rapid and economical.

In the past, rivalry between companies and lack of continuity of management and technical control have hindered the progress of the coal and steel industries in Nova Scotia.

The unity of control and flexibility of operations which has resulted from the consolidation of management should be a great help to the industry, which requires to be most economically administered in order to compete successfully with United States steel products.

The most important advantage of the consolidation is the removal of lease-boundary restrictions in the coal and iron-ore deposits of the associated companies, which were commencing seriously to hamper the mining development of the steel and coal companies before the consolidation was arranged.—Reprinted from "Industrial Canada."

Dr. R. S. McBride, Colorado Bldg., Washington, D.C., secretary of the Gas and Fuel Section of the American Chemical Society, announces that the new section will meet with other sections of the Society at the Fall Meeting to be held in Pittsburgh, September 4 to 9.

Among the topics to be discussed will be the general subject "Combustion" in the form of a special symposium to be conducted under the chairmanship of Prof. R. T. Haslem, of Massachusetts Institute of Technology. It will include a program of papers on chemical methods underlying fuel utilization.

The Manufacture and Use of Black Pigments*

By H. L. BLACHFORD.†

TO go exhaustively into the manufacture of the black pigments and to explain fully their many uses will not be attempted in the scope of this paper. However, what we wish to do is to show in a broad way the general methods of the preparation of blacks and the uses to which they are put, with particular reference to the paint and allied trades.

The different subjects will be covered in the following order: 1, Definitions; 2, The Manufacture and Uses of: (a) Carbon Black, (b) Lamp Black (c) Bone Black, including Drop Black and Ivory Drop Black; (d) Charcoal (Willow, Maple and Bass), (e) Vine and Frankfort Black, (f) Graphite (g) Coal, (h) Black Toners, (i) Asphaltum, (j) Mineral Black, (k) Black Oxide of Iron.

1. Definitions.

Pigments are defined as insoluble solids, which can produce the sensation of color in other substances by being intimately mixed with them in the form of powder or by being spread in a thin film over the surface. The "mixing" is represented in paper-making and the "spreading over the surface" is represented by painting. The color of a pigment depends upon the amount of light it absorbs or reflects.

In white pigments the majority of the light is reflected, and in the black pigments the majority of the light is absorbed; the greater the amount of reflection or absorption, the whiter or the blacker the pigment will be.

Carbon has the power of absorbing light to a greater extent than any other substance used as a pigment, and for this reason the higher the percentage of carbon contained in the pigment, the greater will be the amount of light absorbed, and consequently the blacker the pigment will be.

The above rule seems to be broken in the case of drop blacks, where the amount of carbon is only about 17 per cent. This material, however, is very weak in tinting strength as compared with carbon black or lamp black, so that when mixed with other materials its power of absorbing light rapidly diminishes.

Carbon forms the basis of the valuable black pigments. It is a chemical element with an atomic weight of 12, and on heating it combines with oxygen to form the gas carbon dioxide. It is, however, a very stable element and will remain unchanged by exposure to the atmosphere for any length of time, and can be mixed with other pigments without causing any alteration.

2. Manufacture and Uses.

Black pigments were known in the earliest times, but usually as asphaltum or other of the naturally occurring blacks.

The manufacture of lamp black was one of the great steps forward in obtaining black pigments. Carbon black, which is of comparatively recent origin, has only come into general use since the discovery of large deposits of oil and natural gas in the United States.

Manufacture of Carbon Black.

It is fairly simple to produce ordinary commercial carbon black, but to include in an organization sufficient personnel and research equipment to handle the multitude of various grades, which have become necessary for a business like the paint trade, is a complicated and expensive proposition.

It will be enlightening to outline roughly the general method of manufacturing, and then to touch briefly upon some of the various special processes. A generation or so ago when this business was in its infancy carbon black was only beginning to replace lamp black in the general arts and sciences. For some years natural gas had been developed at various points in the United States, mostly in conjunction with the prospecting for oil. As this work was done in unsettled sections of the country, such gas as was developed was looked upon as useless, and was either capped or allowed to blow into air as waste, since there was no possible use for same. The founders of Binney & Smith Co. were among the first to recognize the potential possibilities in this relatively new natural resource, and it was shortly found that a commercial product could be made which was eminently superior to the old-fashioned lamp black for many purposes. Printing inks were, of course, among the first to which this was applied at the time, and it was only through the use of the new black that the modern art of high speed press work was possible of development. It was soon found, however, that for general color and tinting purposes carbon black was much more economical than the lamp black, since its tinctorial strength is very much greater and its surface color and body is of a higher degree of intensity.

As the various States increased in population it was also found that natural gas was an ideal fuel both for domestic and manufacturing purposes. It is easily piped within normal distances and represents the most convenient heating element on account of its high B.T.U.'s and efficiency. Naturally, as the population increased the demand for such gas was multiplied, and the business has been a succession of migrations from one State to another, in order that new fields might be developed which would allow them to produce sufficient gas for their operations on a basis which would make it possible to use the gas economically, and to prevent its cost being excessive on account of the demand for same. You can, therefore, trace the bulk of production from Pennsylvania to Indiana, to Ohio to W. Virginia, and in latter years to Louisiana, Oklahoma and Wyoming.

Although a small manufacturing unit can operate successfully in a small territory, yet a business of the magnitude which Binney & Smith handle must have tremendous reserves in order to safeguard its customers. This has gradually evolved an organization until to-day they are handling the product in over forty-five separate and distinct manufacturing units, scattered over five States of the Union.

The necessity for such operations can be pictured when we say that a factory may be thrown out of production almost over night. Since they are relying upon a natural resource for the raw material, they cannot regulate the way in which this is taken from Nature's reservoirs. A field which is producing a sufficient volume of gas to-day may through some change of structure within the earth produce none to-morrow, with the consequence that an operating plant may be entirely idle in the course of a few hours. It is also of not uncommon occurrence to have the quality of gas change in as short a space of time, since likewise they cannot control the particular kind of gas which they take from the earth. This means that for the number of operating units mentioned they must provide not only thousands of acres of gas territory for immediate operations, but literally hundreds of thousands of acres of reserve or virgin territory to draw upon against eventualities.

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*An address presented at the April meeting of the Toronto Club of Paint and Varnish Superintendents.

†Canadian representative of the Binney and Smith Co., New York.

Whereas this was once a simple proposition in a few States, the Eastern section of the country is to-day literally a net work of large size pipe lines conveying gas from the various fields for hundreds of miles to the large centres of population. The old law of supply and demand means, therefore, that a higher valuation is placed on such gas as is produced, and puts the Carbon Black Manufacturers on a competitive basis even with the gas produced in their own fields. Although West Virginia is still producing a good percentage of present production, they are drawing heavily upon Kentucky and principally upon Louisiana for the bulk of reserve production to-day. While this means higher freight rates on the finished product, it means that on the other hand that gas can be secured considerably below the figure which would necessarily apply in the old fields.

Taking now an average producing unit, you will find at some remote section more likely than not on a small railroad branch, a group of buildings covering roughly three to four acres. These buildings consist of warehouses, power plant, building for bolting equipment and packing buildings. These are adjacent to the railroad siding for convenience in making shipments. Behind these buildings, in rows grouped about a central shaftway, is a series of tight metal burning houses. Such houses are roughly about 100 feet long by about 12 feet high, constructed entirely of a steel frame with a sheet iron covering. In each of these houses is a table which consists of steel channel beams from 6 to 9 inches wide, bolted together on a frame, the channels being continuous and running the length of the building, generally eight of these channels making up the table with the plate surface underneath. The whole table is carried on wheels running along a track. Underneath the centre of these channels are the supply pipes in which the gas is carried, and these pipes are equipped with the old-fashioned lava or fish-tail burners, which you will recall before the days of the Welsbach light. These burners are spaced about four inches apart, so as to throw their flame upwards against the bottom of the channel as close as possible without interfering. Through these tips the gas without the admixture of air is supplied, so that a slow smoky flame is produced with incomplete combustion. These flames impinge upon the flat surface of the channel and deposit their carbon in the finest imaginable film of soot. All this time the channels are propelled backward and forward on the track, so that at no time does a flame impinge against the same spot in the channel, which is to prevent burning of the deposited black. At set intervals steel scrapers are so arranged as to take off the film of carbon which then drops by gravity into hoppers, and is conveyed by automatic screw conveyors to the first storage bin.

An average plant will consist of from 12 to 30 burner houses, so that from 50,000 to 200,000 separate individual flames are burning under the plates. Such average plants will consume from 2,000,000 to 5,000,000 cubic feet of gas per day of twenty-four hours. The resultant production is figured on the basis of 1 lb. of black per thousand cubic feet of gas.

It may be opportune at this time to comment upon the charge which is sometimes brought against this industry, that we are wasteful, because of the alleged inefficiency of our use of gas. This may seem at first justified, since chemists will point out the fact that there are roughly 30 lbs. of carbon to every thousand cubic feet of natural gas, but this criticism confuses the element carbon, with our commercial product, "Carbon Black."

The element carbon exists in such diverse forms as the diamond and graphite, and in coal, oil, the breath exhaled, and in every kind of organic matter, but the whole industrial value of carbon black lies in its unique form and properties. We have found it possible to increase the yield of mere carbon black from gas, but every one of the methods has thus far proved a failure, because it obtained quantity only at the sacrifice of the qualities on which commercial value depends. The manufacturers are just as much interested in conserving the supply of natural gas, looking toward the protection of their trade in the future, and if we could produce more of this material from a given quantity of gas, it would be to our great advantage to do so.

Going back to the black produced and taken into the initial storage bins, we find that the material is not suitable for shipment since it may contain certain coarser particles which are bound to occur from the nature of the processes. Please remember that the multiplicity of flames operating in a small and confined area gives rise to extreme heat, the temperatures in the centre of the burning house being over 1000°F. If through the slightest mechanical variation the speed of the plates is slackened, then this heat tends to further carbonize and eventually would coke the carbon produced.

As a safeguard, therefore, all material manufactured is carefully screened and bolted through the finest wire gauze. This is a complicated thing, due to the fact that the material is so bulky, having a gravity of only 1.7, and when the material is first received from the burning house a space of one cubic foot would only hold slightly more than one pound of the black. As an ordinary unit produces from 2,000 to 5,000 lbs. per day, the size of such operations can be pictured. After careful bolting proper agitation is given to the black in order to drive out the entrained air between the minute particles so that eventually the uniform quantity of 12½ lbs. can be packed off into the standard bag with which you are all familiar. These bags are either double bagged for shipment in carload lots, or packed in wooden cases for less than carload shipment, and the black is ready for the market.

Method of Supplying Gas for Carbon Black Manufacture

Behind this picture and the operating unit itself, however, we must trace the gas which is supplied for these operations. It may be that within a relatively short distance the field men have located a sufficient acreage of territory where gas has been successfully developed, but it may be just as likely the field is ten or twelve miles distant over a rough and mountainous section of the country. One might think we would locate the factory at the spot where the gas is developed, but this would necessitate hauling the finished black to the railroad, and the piping of gas is a much simpler proposition. Wherever gas has been developed there will be a series of wells drilled, averaging about one to every ten acres, depending upon the volume of gas required at the factory. These wells are drilled with the regulation tools, and vary in depth from 1,800 to 2,800 feet.

The gas sands are usually found in certain distinctive strata, and if they are fortunate enough to drill into a good paying sand, they are apt to strike a rush of gas at a tremendous pressure, which sometimes blows the heavy tools right to the surface of the ground. The pressure at which such gas is developed runs from 200 lbs. to 1,200 lbs. per square inch.

The line laid from the field to the factory is connected by pipe lines, with a main line laid from the field to the factory. The pressure of gas is, of course, sufficient to drive same through the lines, and in fact they generally have to reduce the pressure by regulators in order to prevent the line being blown up. The main lines to the factories vary from six to ten inches in diameter, depending upon the volume of gas required.

When the gas reaches the factory, it is again reduced in pressure and handled in gasometers in order to equalize the pressure and to have the gas delivered into the burning houses at a constant pressure without variation. An interesting fact is the way in which the power is developed at such points as have sufficient pressure. At these places they use ordinary steam engines, and pipe the high pressure gas direct to them, the expansion of the gas acting as the motive power, the exhaust being taken into the low pressure lines and used for burning purposes.

In the field it may be that other producers own territory or leases, and are also seeking to produce as much gas as possible for distributing or other purposes. The reservoirs in which the gas is undoubtedly held within the earth, are, of course, common property, and wherever these reservoirs are tapped, neighbors, therefore, may have drilled into a general reservoir from which others are drawing gas, and in this case an exciting race develops, particularly if the pressure is low, not more than sufficient to provide for actual needs. And such a race means that as many wells will be put down as is practical, and as near the dividing line as 100 feet, the matter resolves itself into an offset drilling campaign, as we must put down a well for every one put down by our neighbor, in order to protect the volume.

Standardizing Production

Looking now towards the matter of quality, the ordinary commercial grades represent, of course, the black of which the most can be produced per volume of gas. In other words, the ordinary process may make it possible to produce from one to one and a half pounds, is set for quantity rather than any particular quality. After the resultant quality has been fixed, however, it is, of course, up to the factory superintendent to maintain same without variation. Practically every gas field produces varying qualities of gas, so that in almost every field a different quality of black would be produced, unless certain set standards were to be maintained. In the case of ourselves, we produce for the different trades some sixteen different standard grades of carbon black. Many of these grades are made at factories in different States, and here, of course, careful testing and processing must be arranged in order to match the necessary quality.

For many years, however, it has been necessary to develop special grades of material for the various industries. Most paint manufacturers desire to put out a high grade line of paints or varnishes. As these are generally quality products, the question of cost may not be of such importance as it is in a staple line, so that the demand has arisen for blacks which should have higher qualities in the line of intensity of color, tone, etc. This has been particularly noticeable in the automobile varnish line, where color is of prime importance. For these various purposes we have found it possible to evolve processes producing black of a distinctively higher quality. However, this necessarily limits the yield, since a larger amount of gas must be used, in order to produce the higher quality blacks, in a given unit. In fact, the Super Spectra Black must be watched night and day to insure uniform drafting and exact application of the flames in the burning houses, in order to come up to its high standard. Such a process barely yields four ounces of black, using 1,000 cubic feet of gas, so that the cost of these blacks can be well understood.

A point which should be kept in mind by every paint grinder, is, that these carbon blacks are extremely hygroscopic, particularly the higher grades. When the material leaves the factories, it has a normal moisture content of approximately 1.4%. If the material, however, is subjected to damp weather in transit, a very large excess of moisture will be absorbed from the atmosphere, resulting, in extreme cases, in a content as high as six to seven per cent. Black of this nature is absolutely unsuitable for grinding purposes, as it will liver, and not mix properly with the vehicles. Even though mixed and properly ground, it will show a multitude of small specks in the finished product, and often give rise to the statement that the black is gritty. We have found, however, that in a great bulk of cases, moisture is the cause of this trouble. This can be taken care of by testing on arrival to determine the exact percentage of moisture, and if any excess above 1.6% is present, the bags can be unpacked from the cases, and either placed in a drying oven for a few hours, or stacked around steam coils for a day or two before mixing. This circulation of warm dry air will rapidly drive off the excess moisture and prevent trouble in the finished produce. Storage of the black in a dry warehouse will, of course, be much better for the reasons outlined above.

In former years it was the custom to make all shipments direct from the factories to consumers, but in view of the fact that a large percentage of the trade consisted of less than carload business, requiring the material packed in cases, it was soon found that the matter of deliveries was inconvenient, and freight charges high. We have accordingly developed a system of distributing points, whereby we keep stocks of various grades of black at a number of different points, including Montreal and Toronto. (To be continued).

PROCESS FOR VOLATILISING AND DECOMPOSING HYDROCARBONS

The Canadian-American Finance and Trading Co., Limited, 511 Union Bank Building, Victoria, B.C., by A. J. Stephens, London, England, has been granted United Kingdom patent No. 174965 on a process for volatilising and decomposing hydrocarbons.

The process is for distilling and cracking hydrocarbons such as tar-sand, by means of superheated steam. The bituminous sand or rock is crushed and graded, and then delivered to a receptacle where the bitumen is melted by means of a steam jacket and internal steam tubes. The mixture then passes to a separating apparatus in which the hydrocarbon is filtered through a partition of silica, sand or the like. The heating fluid, e.g., superheated steam, and crude bituminous substance are intimately mixed, with resulting vaporisation of the volatile substances. The amount of steam and the pressure and temperature are adjusted so that more heat is available than is required for the vaporisation, the excess being utilized in decomposing or cracking the hydrocarbons. The cracking is thus effected without dehydrogenation and polymerisation, which usually occur when the hydrocarbon is heated by external means. The hydrocarbon is then passed to a series of condensers and scrubbers in each of which a predetermined temperature and pressure are maintained, so that various products such as gas oil, kerosene, and gasolene are obtained.

NEW STEEL PLANT FOR NEWFOUNDLAND

The British Empire Steel Corporation is stated to have entered into an agreement with the Newfoundland Government, whereby, before 1928, they will erect a plant, capable of producing 100,000 tons of pig iron annually. They receive in return a royalty of 25 cents per long ton on all iron ore mined. Coke ovens are to be erected, and $3,000,000 spent before 1926. All imported construction materials are to be duty free. The two steel companies in Nova Scotia, the Dominion Iron & Steel, and Nova Scotia Steel, are granted tax exemptions and water power rights. The royalty is to continue until 1940. If these companies fail in their agreement before 1926, an export tax of one dollar per ton will be imposed by the Newfoundland Government on all ore mined and shipped to any part of the world, except Nova Scotia. Before the war, and at the present time, the Wabana iron ores have been largely exported to plants other than Canadian.

American Leather Chemists' Convention

Nineteenth Annual Meeting, Bigwin Inn, Muskoka, June 21, 22, 23

FOR the first time, the Leather Chemists' Association held a meeting in Canada. It was with some hesitation, no doubt, that the committee put the suggestion before members, but the response was excellent, and over a hundred registrations was the result. Bigwin Inn, Lake-of-Bays, is one of the most delightful spots in Muskoka, and the accommodation offered is in every way the best that could be imagined. The party left Toronto during the morning of June 20th, and spent an ideal day, viewing the scenery of the district and the Lakes up to the Inn. A full program had been prepared, covering the results of committees and papers bearing on the science of leather chemistry and the practical problems of the tanner. President F. H. Small reviewed in a brief address the results of the work done during the year and the general progress of the Association. The work of several committees had been very large, and there was evidence on all sides of the closest co-operation among members and representatives of different companies.

H. C. Reed, of New York, presented the annual business report, as Secretary. The papers presented will be printed in the official journal of the Society. A few papers were sent from the European Society of Leather Chemists, and a number of general addresses were delivered.

The principal subjects discussed were:—

"Determination of Moisture in Leather"—F. P. Veitch.
"Influence of Atmospheric Humidity on the Strength and Stretch of Leather"—F. P. Veitch.
"Determination of Epsom Salts in Leather"—R. W. Frey.
"Comparative Observations of the Tanning Properties of Vegetable Tanning Materials, Synthetic Tans, and Mixtures of Vegetable Tanning Materials with Synthetic Tans"—S. Kohn.
"Synthetic Tanning Materials"—T. A. Faust.
"Preservation Effect of Oils and Greases on Leather"—F. P. Veitch.
"Distribution of Grease in Leather"—L. Balderston.
"Determination of Oils and Greases in Leather"—W. K. Alsop.
"The Mode of Occurrence of Tannin in the Living Cell"—F. E. Lloyd.
"The Bacteriology of the Fresh Steer Hide"—Dr. Werry and G. E. Rockwell.
"A Layman in Research"—F. M. Moffat.
"Some Observations on the Histology of Bating Skins"—C. S. Hollander.
"Rapid Washing of Chromed Hide Powder"—W. R. Atkin.
"Progress in the Physical Chemistry of Gelatine"—C. R. Smith.
"Determination of the Water Soluble of Leather"—G. W. Schultz.
"Non Tannins"—F. H. Yocum.
"Time Reduction in the Tanning Process"—R. O. Phillips.
"The Practice of Curing Heavy Hides—E. R. Theis.
"The Science of Curing Heavy Hides"—G. D. McLaughlin.
"The Direct Measurement of the Plumping Power of Tan Liquors"—W. J. Mlejnek.
"The Versatility of a Plumping Method"—H. C. Reed.
"The Plumping Power of Acids"—J. S. Rogers.
"The Importance of Finish in the Cutting and Marketing of Sole Leather"—H. B. Smith.
"Determination of Sugar in Leather"
"Determination of Sugar in Extracts"—I. D. Clarke.
"Comparative Analysis"—H. C. Reed.
"Modern Problems in Chrome Tanning"—D. Burton.
"Chrome Leather Analysis"—L. Balderston.
"Color Measurement of Vegetable Tanning Solutions"—T. Blackadder.

Impressions are all that may be registered here, as the very valuable discussions of three full days' work cannot be reported. They are the reasons why personal attendance at such meetings is necessary.

Professor Lloyd, of McGill, in his own happy manner, pointed out some interesting observations on the location of tannin in the living cell. Tannin occurs in both young and old tissue, and in a great variety of plants. It is a toxic acid, and its function is hardly clear. It may exist in three ways, (1) in solution; (2) as an absorbed complex with carbohydrate, as in astringent fruit; (3) as in tan bark, where it is more loosely connected.

The work of the Research Laboratory of the Tanners' Council and its value, was pointed out in no uncertain manner by Prof. G. D. McLaughlin and E. R. Thesis. These gentlemen, from the University of Cincinnati, are undertaking to develop the scientific end of the tanning art from the very beginning, and have made a start in the curing of hides. Dollars should return to the packing-houses and others, if they will but follow the advice given, as a result of the research work undertaken. It seems that the old practice of putting salt, dirty or clean, on dirty hides, is not the best way. It was shown that the hides should be treated quickly with a 25% brine, and cleaned thoroughly of blood and other non-hide material. If this is done, as well as salting, a sound product is left for the tanning operation, and the present tremendous waste in poor grade hides may be somewhat avoided. The statistics given by these research workers would be well worth the serious consideration of everyone attempting to cure hides.

Tanners are beginning to use the science of Bacteriology. A general address on the subject was given on the results of serious research on the Bacteriology of the Fresh Steer Hide. This is part of the general research work going on, and already the classes of bacteria generally occurring have been identified. Comparative tests show the conditions under which these thrive and destroy or benefit the hide. While the laboratory methods may not be directly applied in the tannery, the fundamental knowledge has been derived, and a means of creating favorable conditions for the bacteria which are desirable should not be so difficult.

Mr. R. O. Phillips contributed an excellent paper on Time Reduction in the Tanning Process. The development of the business was traced, and the application of mechanical equipment pointed out. New tanning materials have shortened the period. A bright future for electric tannage and vacuum processes was predicted.

The Chemist in the Leather Industry

One of the most pleasing features of the whole Convention was the address by Mr. F. M. Moffatt. He represented the Tanners' Council, and is chairman of their Research Committee. He voiced the new spirit, and perhaps the new era, in the Tanners' world. Never before did the trade require their chemists more. During the last two or three years, the manufacturer has learned that there is a scientific side to his business, and that there is a chemists' association. The laymen must act as ballast in the scientific combination of theory, practice, and finance. The research must square itself with sound economic laws. He, on behalf of the Tanners of America, faced the situation, and admitted that an industry which abounded in waste and the destruction of natural resources must take stock of its situation. The tanners are now contributing to science. It must never be again said that "there is $50,000 for legal fees and $5,000 for science." Secrecy must be scorned as poor form. Thus, in his opinion, may an industry which has never been operated in general at any great profit, be turned into a sound scientific business.

Co-operation along the line was pointed out in a paper by Mr. H. B. Smith. As a salesman of leather, he demanded care in finishing, as well as quality. He met the leather consumer and urged tanners to produce a uniform product that would cut to advantage.

Thus, in most profitable manner, matters of vital interest were discussed. Bigwin Inn offers an ideal spot for outdoor recreation. Ideal weather allowed golf, bowling and motor-boating every day, with dancing in the very large pavilion, overlooking the lake. A feature of the trip was the band concert Friday afternoon, given by the Anglo-Canadian Concert Band from Huntsville. Under the able direction of H. C. Clarke, a most excellent concert was rendered. Unless we are much mistaken, there is going to be quite a run on the idea of holding conventions at some of our leading summer resorts, instead of our leading hotel lobbies.

Among those registering were:—

B. S. Agnew, Borne Serymser Co., 80 South St., New York.
Mr. W. K. Alsop.
Mr. G. W. Schultz.
Mr. and Mrs. C. A. Barnes, Anglo-Canadian Leather Co., Bracebridge.
Dr. T. Blackadder, Reed Laboratories, 22 E. 16th St., New York.
J. E. Breithaupt, Breithaupt Leather Co., Kitchener.
H. V. Bretney, H. V. Bretney Co., Springfield.
T. Beardmore, Beardmore Leather Co., Toronto.

G. B. Beal, Beal Leather Works, Lindsay,
H. R. Blatz, Tanner Chemical Co., Toronto.
Charles S. Coe, Yocum Laboratories, 168 Cort St., Irvington.
W. R. Cox, Philadelphia.
Mr. Conway.
F. W. Damon, 214 Purchase St., Boston.
G. W. Dougherty, Ridgeway, Pa.
Casper Drueding, Drueding Bros. Co., 5th and McMaster St., Philadelphia, Pa.
Mr. and Mrs. F. V. R. Evans, 622 Ontario St., Cheboygan, Wis.
T. H. Faust, Yocum Faust, Ltd., London, Ont.
Mr. Fortier, Yocum Faust, Ltd., London, Ont.
Mr. Glass, Yocum Faust, Ltd., London, Ont.
Grasselli Chemical Co.:
    Mr. McNeil, 17 Hudson St., New York, N.Y.
    Mr. Chas. A. McNeil.
    Mr. E. Roach.
    Mr. A. Smithson, Toronto.
    Mr. D. Walkington.
H. Gensemer, Pine Grove, Pa.
Charles S. Hollander, Holmesburg Station, Philadelphia.
Mr. Halton.
Mr. Pellegroom.
Mr. and Mrs. R. C. Jacobsen, Hide & Leather Journal, 136 West Lake St., Chicago.
F. S. Klebart, J. B. Ford Co., Wyandotte.
Dr. and Mrs. S. Kohn, Can. Seaning & Co., Inc., Bridgeburg.
Mr. and Mrs. L. E. Levi, Pfister & Vogel Leather Co., Virginia St., Milwaukee, Wis.
G. Leabs.
H. Leabs.
E. R. Lohaugh, American Oak Leather Co., Cincinnati.
Mr. and Mrs. F. H. Loveland, J. W. & A. P. Howard Co.
Mr. and Mrs. R. Lang, Kitchener, Ont.
Prof. G. D. McLaughlin, Dept. of Leather Research, University of Cincinnati, Cincinnati.
Dr. W. B. Wherry.
Mr. Theis
Mr. Rockwell.
Mr. and Mrs. Marden.
A. J. May, J. H. Ladew Co., Newark.
R. M. Miller, 230 South 7th St., Philadelphia, Pa.
P. J. Mlejrick, Graton & Knight Mfg. Co., Worcester.
A. M. Morrison, Charles S. Walton & Co., Curtis Bay, Baltimore, Md.
Mr. and Mrs. F. R. Mosbaugh, Anglo-Canadian Leather Co., Huntsville.
Mr. and Mrs. C. R. Oberfell, John H. Heald & Co., Lynchburg, Va.
Mr. Orthmann, Pfister & Vogel Leather Co., Milwaukee, Wis.
E. A. Prosser, 138 De Lacey Ave., Plainfield, N.J.
J. S. Rogers, International Shoe Co., Morganton, N.C.
H. C. Reed, Reed Laboratories, 22 E. 10th St., New York.
S. Saxe, 200 5th Ave., New York.
T. J. Shant, Ashland Leather Co., Ashland.
F. H. Small, A. L. C. A., Worcester, Mass.
C. C. Smoot, North Wilkesbarre, Me.
Mr. and Mrs. Sattzer.
W. H. Teas, Marion, Va.
Tannin Corporation, 13 Wellington St. E., Toronto.
Fred Damon.
R. O. Phillips.
W. A. Rushworth.
C. E. Rushworth.
Tannin Corporation, 80 Maiden Lane, New York.
Mr. Clarke.
Mr. Prudle.
E. H. Ellison.
C. W. Tobey, Collingwood, Ont.
Frank Urban, Wm. Mosser Co., Richmond, W. Va.
E. L. Wallace, Bureau of Standards, Washington.
Mr. and Mrs. L. E. Westman, "Canadian Chemistry and Metallurgy," Toronto.
E. W. White, A. C. Laurence Leather Co., Peabody, Mass.
Max F. Walls.
Dr. D. Y. Yen, Hirth Krause Co., Rockford, Mich.
F. H. Yocum, Yocum Laboratories, 168 Cort St., Irvington, N.J.

WORLD'S TIN SMELTING CAPACITY

The British Imperial Mineral Resources Bureau has recently issued statistics showing that the world's tin smelting capacity is considerably in excess of all tin ore production. The annual smelting capacity of all countries is stated as 175,700 tons, while the world tin ore production is given as 120,261 tons in 1919 (the latest production figures. The tin smelting capacity of the British Empire is shown to be 105,400 tons, to which Canada can contribute 800 tons. The United Kingdom's smelting capacity is 33,900 tons, and that of the United States, 30,000 tons. The Straits Settlements (a part of the British Empire) have the largest capacity, 58,000 tons. The capacity of United States tin smelters is 30,000 tons. The tin ore production of the British Empire in 1913 was 53 per cent. of the total, and 46 per cent. in 1919. The report points out that the dependence of the rest of the world on the Empire for tin is not likely to diminish.

PERSONAL

D. Mungall has been appointed chemist with Jenkins Bros. Ltd., Montreal. A laboratory has been opened up.

Chemical Society News

CHEMICAL ENGINEERS VISIT TORONTO

On Tuesday, June 20th, a party of about ninety members of the American Institute of Chemical Engineers paid a brief visit to Toronto. The visiting engineers formed a group of those who attended the semi-annual meeting of the Institute held this year at Niagara Falls, Ont., where over two hundred members were registered for the meeting. The party arrived by boat from Niagara at one o'clock when they were met by local members of the Canadian Institute of Chemistry and Society of Chemical Industry, and conducted on a tour of the city and industrial plants. Owing to the fact that the visitors had to leave at four o'clock, the inspection tour had to be confined to three plants. The party was divided in three sections, one going on a sight-seeing trip around the city, another to the Canadian Kodak Co., and the third to the plants of the Consumer's Gas Co., and the Dunlop Tire and Rubber Co. All three trips proved most enjoyable. The visit to the Consumers Gas works and the Dunlop Tire and Rubber Co., were particularly instructive. At the Gas works the party was welcomed by Mr. Jeffrey, general manager, Mr. A. Hewitt, manager, and Mr. W. Philpott, chemist. These gentlemen made excellent instructors and spared no pains to make the processes of manufacture perfectly clear. The plant is the largest gas manufacturing works in Canada, and also has the largest number of individual meter users in Canada. On the completion of this inspection, the party was treated to refreshments in the offices at Station "B." Here Mr. Hewitt briefly outlined the history of gas manufacture in Canada. He took occasion to tell the visitors what a splendid asset Professor J. Watson Bain had been, not only to the University of Toronto, but to the industries of the city as well. As one of the visitors expressed it, it was indeed stimulating to find in Mr. Hewitt, a business man with such a great interest in and enthusiasm for science. Leaving the gas works the party walked the short distance over to the plant of the Dunlop Tire and Rubber Co., where they were met by Mr. D. B. Beynon, superintendent, and conducted through every department of this splendid factory. If every industrial plant is as busy as this one proved to be, then it will not be long before Canadian business is pretty well reconstructed. Mr. Beynon was later joined by Mr. D. Huether, who assisted in the conduct of the party. Of the entire plant, probably the most interest was taken in the hose department, where all varieties, from the small garden hose to the high pressure fire hose, were being made.

The Kodak Company's plant was visited under the able guidance of Dr. H. van der Linde, and the visitors were delighted with this modern establishment, which is all operated under the latest scientific principles. Those who preferred the motor ride around the city were well taken care of, and Mr. M. L. Davies and Professor J. T. Burt-Gerrans made excellent expositors of the city's beauty spots. Among those present as visitors were: Dr. David Wesson of the Southern Cotton Oil Co.; Dr. Olsen, secretary of the Institute; Dr. Howe, Editor of the "Journal of Industrial and Engineering Chemistry"; Mr. Weiss, Chief Chemist and Director of Research of The Barrett Co., New York, and Mr. F. Hooker, of the Hooker Electrochemical Co., Niagara Falls, N.Y.

TORONTO EXECUTIVE, S.C.I. ELECT OFFICERS

At the First Meeting of the executive of the Toronto Branch of the Society of Chemical Industry, the following officers were elected for the coming year: L. E. Westman, Chairman; Prof. J. T. Burt-Gerrans, Vice-Chairman; E. Rothwell, Secretary; and G. N. Hill, Assistant Secretary.

JUNIOR CHEMIST WANTED FOR RECLAMATION SERVICE

The Civil Service Commission of Canada has given notice that applications will be received for the position of Junior Chemist. Applications must be filed with the Commission not later than July 20th. Application forms may be obtained from the offices of the Employment Service of Canada, from the Postmasters at Prince Rupert, Vancouver, Victoria, Edmonton, Calgary, Regina, Winnipeg, Quebec, Charlottetown, Halifax, Fredericton, and St. John, or from the Secretary of the Civil Service Commission, Ottawa.

Special preference is given to candidates who have not yet been successfully re-established after war service and are on pension, and also to candidates who were on active service and who possess the minimum qualifications for the position. The following are the duties and qualifications:—

4170. A Junior Chemist for the Reclamation Service Branch, Department of the Interior, Ottawa, Ont., at an initial salary of $1,680 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum until a maximum of $2,040 has been reached. This initial salary will be supplemented by whatever bonus may be provided by law.

DUTIES.—Under supervision, to make chemical and physical analysis of soils and waters, saline deposits, etc., following prescribed methods of analysis; and to perform other related work as assigned.

QUALIFICATIONS.—Education equivalent to graduation in chemistry from a university of recognized standing; one year of post graduate laboratory experience, preferably in soil analysis. While a definite age limit has not been stated, age may be a determining factor when making a selection.

EXAMINATION.—A rating on Education and Experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify an oral examination may be given if necessary.

CHEMICAL EQUIPMENT MANUFACTURERS ORGANIZE

Following the National Chemical Exposition last September at New York a committee was appointed to formulate plans for permanent organization and exhibition activities. A meeting was held at New York during May, when details were discussed with directors of various exhibitions including the Textile Exhibition Association, the Automobile Show and the National Exhibition of Chemical Industries. The executive committee in charge are: Chairman, J. G. Lehman, Bethlehem Foundry and Machine Co.; Secretary, A. A. Holmes, E. B. Badger and Sons; P. C. Kingsbury, General Ceramics Co., Paul O. Abbe, Abbe Engineering Co.; and C. H. Kimberley, Schutte-Korting Co.

The Association has for its objects: "The Standardizing of Equipment" (in the past considerable confusion has been caused prospective purchasers through the similarity of products sold under different name by the several manufacturers).

"The promoting of a better knowledge of conditions controlling the industrial development."

"To bring about a definite understanding as to professional services rendered to purchasers with the sale of equipment."

"Will endeavor to protect themselves and customers by determining a new and better method of handling second-hand materials."

These and other problems of common interest suggest considerable activity, the solving of which will beget confidence and suggest fresh avenues of movement.

This organization marks another step in the business progress of chemistry in the United States.

The address of the Secretary is: A. A. Holmes, Chemists' Club, New York.

ANNUAL CONVENTION OF AMERICAN OIL CHEMISTS SOCIETY

The annual convention of the American Oil Chemists Society was held this year in New Orleans on June 7th and 8th. What was lacking in numbers, due to change in date and financial conditions in the oil industry was largely compensated for by the enthusiasm of those present. This society has adopted the plan of the A.S.T.M. and other scientific organizations of having its committee reports printed and distributed at the meetings. These reports were discussed and expeditiously disposed of, leaving plenty of time for the consideration of a number of important papers.

Dr. Geo. S. Jamieson, Chemist in charge of the Oil, Fat and Wax Laboratory, of the United States Bureau of Chemistry, presented some of the results of his laboratory's investigations of the composition of cotton-seed oil in a paper on "The Analysis of Crude Vegetable Oils." He outlined a method for the determination of the actual quantity of pure glycerides present, and said that there were other substances in cotton-seed oils beside free fatty acids which combined with caustic soda in the usual refining processes. A small quantity of these had been isolated, and it was proven they contained phosphorus and other inorganic radicles. When the chemical identity of the non-fat bodies in oils has been determined and their effect upon commercial refining operations is known, it will be much easier than at present to judge of the efficiency of factory refinings.

Dr. David Wesson, Technical Director of the Southern Cotton Oil Co., exhibited the new E.K. Colorimeter, which he has been studying as a possible solution of the present difficulties in satisfactorily grading oils for color. He also showed lantern slides of another instrument which is being perfected, and a number of color absorption curves of oils and Lovibond glasses. These curves for refined cotton-seed oils show a striking depression at one point in the red which is nearly eliminated by bleaching with Fuller's earth. Dr. Wesson said that with the K. and E. instrument, it would be possible to tell when an oil had been partly bleached and also whether or not any given refined oils were bleachable.

The silver loving cup for most accurate work in the determination of both oil and ammonia in 38 samples of oil-meals, which is given annually by the Society, was awarded at the banquet, to Mr. H. B. Battle. A number of certificates for proficiency in the analysis of oils, fertilizers, soap stock and fats were distributed by Mr. Herbert Bailey, Chief Chemist of the Southern Cotton Oil Co., as a part of his report on the work of the Co-operative Analytical Program.

For the ensuing year the following officers were elected: President, L. M. Tolman, Chief Chemist, Wilson & Co., Chicago; Vice-President, H. B. Battle, Montgomery, Ala.; Secretary-Treasurer, Thos. B. Caldwell, Wilmington, N.C.; Editor, Chemists Section, Cotton Oil Press, Herbert Bailey, Savannah, Ga.

CHEMICAL SOCIETY OF WOMEN

Fifty Pittsburgh women chemists, the largest group in any city of the United States who have completed regular courses in chemistry and are making it their life profession, have applied for an Iota Sigma Pi charter and expect as a feature of the coming September convention of the American Society to be installed as a regular chemical society of women, of which there are relatively few in the United States.

Prominent in the group are:—Catharine Charlton, Biochemist, New Kensington Hospital; Nelly B. Green, Chemist, Duquesne Works, Carnegie Steel Co.; Charlotte H. Miller, Chemist, Hope Natural Gas Co.; Sue F. Smith, Chemist, Koppers Co.; Mary Wilson, Instructor in Chemistry, Pennsylvania College for Women; Alice Wakefield, Industrial Fellow, Mellon Institute; and Ida M. Hood, Instructor in Chemistry, Carnegie Institute of Technology.

World Conditions and News in Chemical Fields

(Special Correspondence to Canadian Chemistry and Metallurgy by our London Representative.)

Demand for Nitrate of Soda Continues Firm

The strong demand for the principal forms of nitrogen has continued in most countries.

The United States consumers took up not only the whole of the available stocks of nitrate of soda in that country, but also called for shipments from Europe. This induced the American Government to place on the market a portion of their reserve stock, and, as a result of this, demand has been quieter. Before this stocks of current production of sulphate of ammonia in the United States had all been sold for some weeks ahead.

The position with regard to the European stock of nitrate is not, however, quite as favorable as was anticipated, and it is expected that the quantity carried over to next season will run into six figures.

In this connection it is interesting to note that the Nitrate Producers' Association has now fixed prices for the whole of the coming consuming season. The new prices in themselves are hardly calculated to fulfil the expectations of consumers, but one satisfactory feature about them is that the Producers' Association are now quoting per metric quintal of 100 kg., instead of, as formerly, per Spanish quintal. It may be anticipated that nitrate will be available for consumers in Great Britain and Europe at about £13 to £14 per ton, according to the time of shipment.

A Substitute for Shellac

It is claimed that a German chemist has perfected a substitute for shellac made from Accaroid resin. According to the Chemische Umschau the resin is finely powdered, mixed with a metal oxide, and heated with mineral acid to 70-80 degrees. The acid absorbs the coloring material and probably the metal oxide. It is then poured off, and the residue is washed first with soda solution and then with cold water.

A British firm is making experiments on this discovery, and the results will show whether the substitute can be of commercial value. If it is based on sound scientific fact it will have important results, since the price of real shellac obtained from lac as a result of various treatments has always been extremely high.

Manufacturers of polishes and varnishes will welcome a substitute which would yield the same satisfactory results at a much lower price. The discovery is of interest also to silk hat manufacturers, who use shellac in the stiffening of the calico frames, and also to firms engaged in the manufacture of the best sealing wax. Manufacturers of gramophone records may also be interested in this discovery.

Synthetic Shellac

A new synthetic shellac has been put on the British market under the name of "Synlac." It resembles natural shellac very closely in its technical qualities; it dissolves perfectly in all proportions in cold methylated spirit, making a turbid solution which, when applied as a varnish, makes a glossy film of a color equal to the very finest orange shellac.

It is claimed that this preparation, like shellac, makes an exceedingly dense varnish. In fact, it is said that 2 lbs. of synlac per gallon of spirit gives approximately the same body as 4 lbs. of copal or sandarac, thus making it an economical material to use as a cheapener for shellac, especially as its technical qualities render it by far the most efficient material for mixing with that article.

Analysis shows that the constituents of synlac and shellac are practically alike, not only in identities but in proportions, and this fact is of considerable importance.

The Electro-Deposition of Iron

The Department of Scientific and Industrial Research in London has just issued (H. M. Stationery Office: 6/6 net) a Bulletin on the Electro-Deposition of Iron by Mr. W. E. Hughes, B.A., late Chief Research Chemist, Electro-Metallurgical Committee, Ministry of Munitions, with a useful biliography of the subject. The Report includes, as Division 1, simple descriptions of the structures of a number of samples of iron, electro-deposited from the chloride of iron solution, showing how the three factors of deposition, (1) temperature, (2) current density, and (3) movement of cathode or electrolyte, affect it. Division 2 is Theoretical, but in Section III. the importance of the study of the structure of deposited metal to electrodeposition in the workshop is briefly pointed out.

Commercial Oil From Cinnamon Bark

Cinnamon is a plant of the laurel order of which the Cinnamomum Zeylanicum, extensively grown in Ceylon, is the finest kind. The commercial value of the plant lies in the bark, which is stripped off, exposed to the sun, dried and tied up in bundles of about 88 lbs. in weight.

Up to the present, the bark which depended for its aroma and properties upon the presence of volatile oil, has been chiefly used for culinary and medicinal purposes. It has been used as a condiment by cooks and confectioners, and pharmacists prepare it as an astringent and a cordial.

Recently, however, as a result of experiments made with a Madagascar cinnamon bark, it has been found possible by means of steam distillation to extract from 56 lbs. of bruised bark about 40 grammes of oil.

The distillation waters obtained by the process of direct separation from the oil, yielded on extraction with petroleum ether 74 grams of a quite different oil to that obtained by the "direct" process, showing a total yield of 0.47 per cent. The direct oil showed on an analysis a specific gravity at 15 deg. of 0.9731; optical rotation—5° 2′; acid value, 2.49; Aldehydes, 48 per cent.

The oil derived from the distillation waters showed specific gravity at 15 deg. of 1.0297; optical rotation, 2° 2′; acid value, 2.49; Aldehydes, 82 per cent.

Both oils were easily soluble in 70 per cent. of alcohol.

Should this process prove commercially successful the utilisation of the oil will assure it a wide market.

It should be noted that prior to the war about 75 per cent. of the cinnamon bark from Ceylon was exported to the United Kingdom.

Reduction in Chilean Copper Exports

From preliminary figures published in the monthly bulletin issued by the Chilean Government Statistical Office, it appears that during last year there was a considerable reduction in the exports of copper. Copper bars totalled 47,756,455 kilos., valued at 34,053,163 pesos., as against 85,164,786 kilos., valued at 94,182,182 pesos in 1920; matte amounted to 324,354 kilos., valued at 88,519 pesos, as against 3,699,711 kilos., valued at 1,641,050 pesos; while ore shipped figured at 48,708,866 kilos., valued at 3,490,664 pesos, compared with 24,769,403 kilos., valued at 2,561,366 pesos. The greater part of the export of copper bars and matte during 1921 represents a reduction in actual supply of refined and semi-refined copper in Chile, as production was restricted early in the year. The majority of smelters in the country were closed down during the year, and, with the exception of a very few mines whose ore was sufficiently rich to pay for extraction, the smaller mines, which produce ore for custom smelting or for export, were inactive. Stocks of refined copper are said to have been very materially reduced, and it is known that considerable quantities have been sent to Germany. The situation is thus much healthier, and with an increased firmness in general industry, practically normal operations and conditions may be attained.

Notes

It may be of interest to petroleum refiners, says "Commerce Reports," to know that an electro-chemical process is stated to have been perfected for the manufacture of metallic calcium, and of 97.5 per cent. caustic soda, free from chloride of soda. It is claimed that the new process is much cheaper than those now in use, and that the products should therefore be of use in the distillation of oils for electric transformers, etc.

The world's output of oil in 1921 is estimated by the American Petroleum Institute as 759,030,000 barrels, as against the actual production in 1920 of 694,853,000 barrels.

REPORTS OF ONTARIO DEPARTMENT OF MINES

Gowganda and Other Silver Areas.—This is Part III. of Vol. XXX., of the Ontario Department of Mines Reports and was prepared by Mr. A. G. Burrows. The report constitutes a very valuable work on the Gowganda and also Auld and Cave Townships. The geology of these important producing areas is thoroughly discussed and an important section of the report deals with a description of the mines and prospects. The report is illustrated with maps and charts.

Natural Gas in 1920 and Oil Field Operations, 1921.—By E. S. Estlin, Commissioner of Natural Gas for Ontario. Probably the most important section of this report is that dealing with the efforts made by the Department in co-operation with several gas companies for prolonging and conserving the gas flow in the various districts. A three page table is given showing the cities and towns in Ontario using gas and the rates charged by the distributing companies. The problem of the entrance of rock water into the gas wells in Kent County is discussed, as this is a matter that very seriously threatens the life of the wells in that country. The influx of the water is somewhat retarded by maintaining as high a field pressure as possible, but as the general field pressure declines, the water increases.

"The Oil Field Operations," section of the report deals with the production of crude petroleum in Ontario, and also the refining.

PERFECTED RADIO AMPLIFIER AS RESULT OF RESEARCH WORK

The Bristol Company of Waterbury, Conn., has recently produced and placed on the market a Loud Speaker Horn under the trade mark name "Audiophone" for receiving radio concerts, speeches, etc. While the Audiophone is a comparatively new development in the radio field, it is not an experiment but the result of thirty years 'experience in the development and manufacture of precision recording and indicating instruments, and six years research work in sound reproduction. The Audiophone is the result of long and careful research work carried out at the Research Laboratories of The Bristol Company, to develop a loud speaker for use with the new Bristol Talking Moving Pictures, which are soon to be placed before the public. The result of this research produced a loud speaker which gives a large volume of amplified sound, and yet faithfully reproduces the original.

The Audiophone is of a compact and artistic design, finished in bronze. The bell of the horn is fifteen inches in diameter. The complete design of the bell, neck and electrical characteristics of the receiver box, together with materials used, are such as to produce an amplifier remarkable for its rich, natural and clear tone, giving sounds that are distortionless. Songs, addresses, instrumental music, etc., are reproduced with a most remarkable clearness and audibility.

Full information regarding this amplifier can be obtained from the Canadian representatives of The Bristol Co., A. H. Winter Joyner, 62 Front St. W., Toronto, and New Birks Bldg., Montreal.

HAMILTON, ONT.—The Canadian By-Products Co., Limited, have been incorporated, $600,000, to manufacture fire brick and refractories under Dominion basic patents from anthracite coal ash. Building operations will commence as soon as a site has been chosen.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy)

The Granby Annual Report

Though the financial statement in the Granby Consolidated Mining, Smelting & Power Company's annual report shows that, after charging depreciation with $300,000, there was an operating deficit of $287,161 for the year ended December 31, 1921, from a metallurgical view point, the year cannot be regarded as other than a most successful one; and even the deficit looms small when it is compared with the enormous deficits of the big copper-producing concerns in the United States, such, for example as the deficit of $8,539,068 that the Phelps Dodge Corporation's annual report shows.

The most noticeable feature in the Granby report is that the cost of production of copper was reduced from 15.94 cents in 1920 to 11.63 cents, a reduction of 27 per cent. This great reduction was made possible by marked improvements in metallurgical practice, and by the loyalty of the staff and workmen alike in accepting reductions in wages, rather than see the big plant close down. During the year, the company smelted 896,802 tons of ore from its own mines, and 16,206 tons of custom ore, and produced 29,970,651 lbs. of copper, 493,283 ozs. of silver, and 8,838 ozs. of gold. This production compares with 25,744,327 lbs. of copper, 1,054,206 ozs. of silver, and 9,481 ozs. of gold in 1920; it should be stated, however, that three-quarters of the silver production in 1920 was obtained from Dolly Varden ore, which was purchased by the Granby company. The slight reduction in the gold output was due to barren quartz being used for fluxing purposes, instead of very low-grade gold-bearing quartz. At the end of the year the ore reserve stood at 10,761,527 tons, a decrease of 224,893 tons, compared with the end of the previous year. In addition to the new high-grade ore that was "drilled in" during the year, consisting entirely of lateral and vertical extensions of the present known ore bodies, a new body of massive sulphide ore, running 0.5 per cent. of copper and very high in sulphur and iron was discovered by diamond-drilling. Though this body of ore is of no commercial value at the present time, should a demand for sulphuric acid be created in the Province, it may become valuable for the manufacture of that chemical.

Owing to improvements that were made in the metallurgical practice both in the smelter and in the coke-ovens, considerably less coke was required for the amount of ore smelted than during any previous year, consequently it was found necessary to operate the coke-ovens at only 43 per cent. capacity. From the 89,543 tons of coal that was charged into the ovens, 56,021 tons of coke, 2,193,555 lbs. of ammonium sulphate, 188,901 gals. motor fuel, 661,046 gals. tar, and 137,000 thousand cubic feet of fuel gas were obtained. A change was made at the coke-oven plant in December, and in future concentrated ammonia liquor, which is in demand by makers of explosives, will be made instead of ammonium sulphate, nearly the whole of which was marketed in the Orient.

The company's Cassidy colliery, on Vancouver Island, produced 215,211 tons of marketable coal, of which 89,529 tons was used at the company's coke-ovens and mines, and the remainder was sold.

No capital expenditures of importance were made during the year, but, with a view to future economies, the directors recommend the constructure of a new reservoir, and improvements to the existing power plant and the erection of a 1,000-ton concentrating plant, to treat the large reserve of silicious low-grade ore that cannot economically be treated by pyritic smelting. It is emphasized that this ore can be handled more economically if mined with the higher-grade smelting ore and treated separately. The construction of the dam for the new reservoir already is well under way, and it is expected that the improvement will be completed before the end of the year, and that it will result in the saving of from $150,000 to $200,000 annually. The capital for the improvement has been fully subscribed by the shareholders of the company. The general outlook for the company is excellent, and it would not be surprising to find the company paying dividends again next year.

Consolidated Company's New Issue

At a meeting of the shareholders of the Consolidated Mining & Smelting Company, the issuing of $7,500,000 of convertible, refunding seven per cent. debenture bonds was approved. Only $6,000,000 will be issued at the present time, and the shares may be exchanged for fully-paid shares in the capital stock of the company. One million dollars of the issue will be used for the erection of the first 1,500-ton unit of the concentrating plant to treat the Sullivan mine ore. The new concentrating plant will be built at the Sullivan mine, and thus a considerable saving in the cost of ore transportation will be effected. When this plant is completed, the plant at Trail that now is being used to concentrate the Sullivan ore will be used to concentrate the gold-copper ores from the company's Rossland mines.

Silversmith Flotation Plant in Operation

In the middle of May, the flotation plant at the Silversmith mine was put into operation, and the plant is turning out silver-zinc concentrate at the rate of about 400 tons per month. The concentrate averages about 35 ozs. in silver, and 50 per cent. of zinc, and under the new zinc schedule of Trail, it is estimated that this concentrate will net the Silversmith company about $23 per ton. There is some 2,000 tons of zinc concentrate that was made in the old mill on the dumps at the mine, and this, too, will be shipped to Trail. The gravity department of the Silversmith concentrator is turning out 400 tons of silver-lead concentrate monthly, and about 100 tons of crude silver-lead ore is being shipped per month. Most of the silver-lead concentrate is being sent to the Bunker Hill & Sullivan smelter, at Kellogg, though some is being sent to Trail and some to the United States Smelting & Refining Company.

Premier Company Buys More Property

H. A. Guess, vice-president and managing-director of the Premier Gold Mining Company recently made his semi-annual visit to the Premier mine, near Stewart, and while there took an option for the Premier company on the Northern Light group, from Charles and William Bunting, the original locators of the Premier mine. This group, which comprises eight full claims and two fractions, is situated north of, and adjoining, the Premier company's present holdings. The consideration is $125,000, and a cash deposit of $5,000 has been made. The agreement calls for certain development to be done, and Mr. Guess stated that this work would be started at once. It is understood the company will disburse another dividend of half a million dollars for the second quarter in the year.

Portland Canal District Booming

A. B. Trites, of Fernie, and New York associates have taken an option on the Big Missouri, at the foot of the Salmon River glacier. Mr. Trites is one of the principal stockholders in the Premier company, and it is understood that his associates are practically the same as those associated with him in the Premier mine. The Big Missouri was under option to Sir Donald Mann and associates, who formed the Pacific Exploration Company to exploit it, but after doing a large amount of diamond drilling, tunnelling, and surface-trenching, the result of which never has been divulged, the option was relinquished, it is said, on account of the inaccessibility of the property. The group, which contains 16 claims and four fractions, is situated some six miles higher up the Salmon River than the Premier. Some immense bodies of ore, said to run about $10 per ton in gold and silver, have been exposed by surface trenching. Some idea of the extent of these ore bodies may be obtained from the report of one engineer who estimated that, provided the ore persisted, every 20 feet in depth would contain a million tons of ore.

Besides these big, strongly-financed concerns, a number of small companies are operating in different parts of the district, and there are more prospectors in the hills than at any time in the history of the district. Engineers, too, are arriving by nearly every boat to look over the district, with a view to picking up likely properties.

BRITISH COLUMBIA INDUSTRIAL NOTES

John Herb, Michael Herb, and A. M. Onkels, all formerly of Wisconsin, have incorporated the Westminster Paper Mills Co., Ltd., with a capital of $250,000, for the purpose of erecting a plant for the manufacture of tissue paper at New Westminster. This, it is believed, will be the only concern of its kind on the Pacific Coast.

Marine Products, Ltd., has been organized with a capital of $150,000, to take over and operate Tucks Inlet By-products Co., which has been idle for some time. The old plant is being put into order, and the buildings are being repaired. The company will manufacture fish oil, fish meal for hog and chicken feed, and fertilizer. G. G. Bushby, one of the principal shareholders, is in charge of the work.

The Consolidated Oil & Development Syndicate has sent an expedition and drilling outfit to its property, near Hudson's Hope, where drilling for oil will be started.

Johnston & Gill, of Kamloops, has re-started its brickyard, and is turning out 20,000 bricks daily.

DISTILLATION METHOD RECOMMENDED FOR DETERMINING VOLATILITY OF NATURAL GAS GASOLINE

In the paper given before the Toronto Section of the Society of Chemical Industry, January 27, 1922, by Mr. W. A. P. Schorman, superintendent of refining, British American Oil Co., and published in this journal in our March issue, Mr. Schorman referred to the extreme volatility of natural gas gasoline and to the risks involved in the transportation of it. The results of a study of these hazards by the United States Bureau of Mines in co-operation with the Association of Natural Gasoline Manufacturers and the Bureau of Explosives are given in a report by D. B. Dow, chemist of the Bureau of Mines, now being distributed by the Association of Natural Gasoline Manufacturers, 821 Mayo Bldg., Tulsa, Okla.

Several very disastrous explosions have occurred in the shipment of natural gas gasoline, the two largest being caused by removal of the dome covers from the cars without previously relieving the internal pressure.

It was found by a large number of experiments that the present method for determining the vapor pressure of natural gas gasoline is not accurate.

The method of determining the volatility of natural gas gasoline by means of distillation loss was found to be very accurate and gave results that could easily be duplicated. It is recommended, therefore, that the distillation method be adopted.

It was found that pressures developed in standard cars were much higher than pressures developed in insulated cars, particularly in summer months. Due to this difference in pressure, insulated cars are desirable for the shipment of natural gas gasoline, not only from the standpoint of safety, but also from the standpoint of economy.

Improvements should be made on dome covers, safety and outlet valves on tank cars. There are several disadvantages in the use of compressed air for unloading tank cars, but from the standpoint of safety any method that eliminates the removal of the dome cover and does away with the outlet valves, is desirable.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST

Reported specially for "Canadian Chemistry and Metallurgy" by A. E. MacRae, Ottawa.

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Treatment of Argentiferous Sulphide Ores.

F. E. Elmore, 217901, April 25, 1922. Pb-Zn ores containing Ag are heated with $NaCl$ in the presence of air to at least 400° to volatilize a substantial proportion of $PbCl_2$ the ZnS being substantially unattacked. The Ag is extracted from the residue with a strong solution of Ca or Mg chlorid containing HCl not greatly in excess of the amount required to convert the Pb present into chloride.

Processes for the Extraction of Lead and Zinc from Their Ores.

F. E. Elmore, 217900, April 25, 1922. Pb-Zn ores are treated with H_2SO_4 in the presence of a brine solution to cause the Pb to pass into solution leaving the ZnS unattacked. The hot solution is separated from the ZnS aod cooled to remove the Pb salts. The solution may be heated again for reuse.

Separating Metals by Electrolysis.

N. V. Hybinette, 217914, April 25, 1922. Ni is deposited at the cathode from an anode containing an alloy of Ni by separating the cathode from the anode by a filtering diaphragm and effecting a flow from the cathode to the anode of an electrolyte, which at its entrance into the cathode compartment, contains more free H_2SO_4 than is appropriate for producing a good quality Ni at the cathode and obtaining the desired acidity at the cathode surfaces by the migration of acid ions through the diaphragm. The anode solution is drawn off at the top and bottom of the anode compartment and regenerated by causing it to flow through an electrolyte tank with insol. anodes where the desired amount of acid to regenerate it is set free and a corresponding amount of Ni deposited.

Catalytic Oxidation.

C. B. Downs and C. G. Stupp, 217981, April 25, 1922. Hydrocarbons in the vapor phase are oxidized with O by passing the mixture through thin layers of a catalyst heated to the desired temperature. The excess of heat is removed from each layer of the catalyst by cooling means, which is out of direct contact with the catalyst and so placed that the vapor mixture itself intervenes between the catalyst and the cooling means to remove heat from the reaction zone by radiation. The oxidation of $C_6H_4(CH)_2C_6H_4$ to $C_6H_4\,(CO)_2\,C_6H_4$ with a temperature range of 425-475°, is specified. Special apparatus is also sbown.

Bottom Blocks for Battery Cells.

C. A. Saville, 217998, April 25, 1922. A storage battery has lead base members rigidly connected together by cross plates in parallel spaced relationship and adapted to hold separator plates of the battery.

Urea from Cyanamide.

E. Lie, 218050, April 25, 1922. Cyanamid is converted into urea by treatment with $Ca(NO_3)_2$ in the presence of water at a temperature above 80° but below that at which the urea formed would be converted into NH_3.

Cyaniding Precious Metal Bearing Materials.

J. C. Haun and A. Silver, 218077, May 2, 1922.

Process for Oxidising Hydrocarbons.

G. Teichner, 218215, May 2, 1922.

Electrodes.

C. G. Fink, 218245, May 2, 1922. An electrode resistant to anodic disintegration is made up of an alloy of Co and from 7 to 20% of Si, Mn, and Cr. This electrode has particular value as an anode in the electro-deposition of Cu.

Zinc Oxide.

W. L. Coursen, 218262, May 2, 1922. In the production of ZnO by the retort volatilizing process a substantial body of molten Zn is maintained in the retort and further amounts of solid Zn is added from time to time to make up for that which has been volatilized.

Manufacture of French Oxide.

J. A. Singmaster, 218263, May 2, 1922. ZnO is produced by the retort volatilizing process in a continuous manner by maintaining a body of molten metal in the retort and adding further amounts of Zn preferably in molten form to the retort, from time to time, to make up for that which has been volatilized.

Iron Production.

P. H. Fraser and J. Kettlaman, 218286, May 2, 1922.

Aldehyde Fatty Acids From Mineral Oils.

J. H. James, 218304, May 2, 1922. Aldehyde fatty acids are made by passing a mixture of mineral oil vapors and air through a heated catalyst, the amount of air and the temperature used being such as to give the desired combustion products.

Refining of Lead.

H. Harris, 216368, March 7, 1922. Apparatus for refining metals comprises a pot adapted to contain molten metal, an open ended cylinder adapted to contain a molten reagent and having its lower end beneath the surface of the molten metal in the pot, a distributor at the upper end of the cylinder and a device for charging the distributor with molten metal.

Dezincing of Lead.

H. Harris, 216367, March 7, 1922. Molten Pb is heated with a fused mixture of alk. chloride and a substance such as NaOH or $ZnCl_2$ which lowers the m.p. of the alk. chloride. Air may be blown through the mixture.

Manufacture of Bichloride of Mercury.

K. Schantz, 216410, Marcb 7, 1922.

Arsenic Purification.

C. P. Linville, 216446, March 7, 1922. A substance containing As and Se is heated to distil the As and Se, and the hot gases are brought into contact with an Ag containing body to effect a separation of the Se from the volatile oxide of As.

Distilling Pyroligneous Acid and Evaporating Acetate of Lime.

H. C. Merriam, 246480, March 7, 1922. The liquid condensate from the destructive distillation of wood is distilled in separate stills and the hot vapors from the stills is conducted into thermal contact with acetate of lime solution. The vapors from the different stills are maintained separate throughout the course of their thermal contact with the solution, and the condensate of the vapors is separately delivered. Apparatus is also specified.

Concentrating Ores.

S. H. Dolbear, 216508, March 7, 1922. The froth formed in the ore pulp by areation is diverted from the column at a point below the atmospheric surface of the column of pulp.

Ammonia Synthesis and Catalyst.

J. C. Clancy, 216513, March 7, 1922.

Process of and Catalyst for Forming Nitrogen Compounds.

J. C. Clancy, 216514, March 7, 1922. A spongy self supporting catalyst consisting largely of BaCN is made by slowly heating $Ba(CN)_2$ to 400-500° in an atmosphere of N. Compounds of Ni Mn, Cr, Ti, W, V and U yield similar compounds which may be used in the production of HCN from H, N and hydrocarbons at dull red heat, preferably under 100-1000 lbs. pressure per sq. in.

Ammonia Synthesis.

J. C. Clancy, 216517, 216518, 216519, 216520 and 216521, March 7, 1922.

Refrigerant.

A. C. Crawford, 216560, March 7, 1922. Propylene is used as a refrigerant. Butylene may also be used but is not as efficient.

Production of Ammonia.

J. C. Clancy, 216515, March 7, 1922. NH_3 is produced by passing N and H under pressure in contact with a catalyst containing Na_2CN_2 or a mixture of Na_2CN_2 $MnCN_2$ and $CoCN_2$.

Process of Producing Ammonia.

J. C. Clancy, 216516, March 7, 1922. NH_3 is prepared by passing a mixture of H and N under pressure in contact with a cyanamid containing compounds in which is present a metal of the Co group intimately associated with an alkali metal and Mn.

Pulp Article.

A. Tingle, 217995, April 25, 1922. A pressed pulp article made from ligno-cellulose has the surface hydrated and relatively impermeable by varnish.

Pulp Article.

A. Tingle, 217996, April 25, 1922. Ligno-cellulose is pressed into the desired shape, treated superficially with H_2SO_4, washed, dried and coated with varnish.

Bleaching Vegetable Fibres.

Geo. G. Taylor, 217811, April 18, 1922. Fibre is subjected to a hypochlorite in the presence of free H_3BO_3.

Refrigerant.

A. G. Crawford, 216558, 216559, 216560, and 216561, March 7, 1922. A mixture of propane and butane is used. A refrigerant having a b.p. of —10° is formed by subjecting a Mixture of 80% butane and 20% propane to 45 pounds per sq. in. pressure.

Process for the Preparation of Sodium Pentaborate Direct from Boron Ores.

A. A. Kelly, 216377, March 7, 1922.

BARIUM AND STRONTIUM IN CANADA

A comprehensive report on barium and strontium minerals in Canada has been prepared for the Department of Mines, Mines Branch, Ottawa, by Hugh S. Spence, and just recently issued in booklet form. Chemists and mining engineers are, for the most part, well acquainted with previous reports of Mr. Spence on various mineral deposits of Canada. Mr. Spence has won a well merited reputation for compiling reports that are a model in conciseness and clearness, and at the same time of such comprehensiveness as to give a wealth of valuable information. The report on Barium and Strontium is no exception to the author's past reports, and not only reflects credit on the compiler, but on the Department as well.

The report is in two parts, the first dealing with Barium and the second, Strontium. In Part I. a history of barytes mining in Canada is given, followed by sections on mode of occurrence and character of Canadian barytes, production figures, the barytes and barium products industry in the United States and other countries, mines and occurrences, and sources and uses of barium. Part II. on Strontium, is subdivided concurrently into sections on celestite mines and occurrences, stronianite, sources of strontium and uses of strontium. Fifteen plates and eighteen drawings illustrate the report.

The report shows that the hitherto exploited occurrences of barium and strontium minerals in Canada are all situated in Eastern Canada, and chiefly in Ontario and Nova Scotia. Barytes mining has had its greatest development in Nova Scotia, the important deposits at Lake Ainslie having furnished the bulk of the barytes produced in Canada. A number of small, scattered deposits occur in southeastern Ontario, but these are not considered of any great economic importance. In recent years, important bodies of barytes have been discovered in northern Ontario. Unfortunately some of the most promising deposits in this region are situated too far from a railroad to permit of their exploitation at the present time. Large deposits are also stated to occur in British Columbia near Spillimacheen, on the Kootenay Central railway, but no development of these occurrences has taken place.

With the exception of a few hundred tons produced in the Lake Ainslie district, Nova Scotia, there has been practically no output of barytes in Canada for several years past. The cause for this would appear to be not lack of barytes, but the comparatively low price at which barytes has been selling. Barytes is produced very cheaply in Missouri, Georgia and Kentucky, the mineral occurring as lumps in clay and being dug out by hand (Missouri) or by steam shovel (Georgia).

Canadian barytes costs more to mine, and there is in addition, the remoteness of many of the deposits from the consuming centres to be considered. Also, Canadian vein barytes is often harder and more difficult to grind than the soft Missouri barytes.

Barytes finds its greatest use in the manufacture of paints and rubber goods. In these industries it is used either in the form of ground barytes or as lithopone, a product of barytes and zinc blende.

The only strontium mineral of importance occurring in Canada is the sulphate of strontium, celestite, which is only known in possible economic quantities in southeastern Ontario. The known deposits are not very large, but, in one or two instances, are regarded as capable of successful exploitation, should an active demand for celestite arise. Most of the celestite consumed on the American continent is imported from England, and is used principally for the preparation of strontium hydrate which is employed in the refining of beet sugar. In the manufacture of fireworks strontium salts are used to produce red fire.

Copies of the report may be obtained from the Director, Mines Branch, Department of Mines, Ottawa.

PERSONAL

Mr. H. C. Hoops of Sinclair, Valentine and Hoops, Limited, Toronto, and Mr. F. A. Ridgway, manager of the chemical department of the company, have returned from a six weeks' business trip to England. During their stay in England, they were successful in securing the Canadian and American agencies for several of the leading English chemical manufacturing firms, as well as making most satisfactory arrangements with regard to shipping, extended credit, etc. Included among the agencies they secured, were: Boks and Co., Ltd., London, the well-known distributors of raw rubber; British Zinc Products, Ltd., Swansea, manufacturers of high-grade zinc oxide; H. L. Morgan Co., Ltd., St. Austal, china clay; L. Taylor and Co., Ltd., London, varnish gums; and F. Jones and Co., Ltd., Swansea, chemicals. Mr. Hoops and Mr. Ridgway report business conditions to be improving steadily overseas. They were impressed with the enthusiastic determination of the British chemical manufacturers to win their way through out of the present period of readjustment. The export business of England shows particular advancement.

READER'S INFORMATION SERVICE

Nearly every week enquiries are received at the office of Canadian Chemistry and Metallurgy, by telephone and letter from readers wishing to know where they buy a certain chemical or equipment. Very often the question is asked is such and such a chemical made in Canada. These enquiries come in so frequently that it has been decided to organize the service given in this regard, and an "Information Bureau" has therefore been opened for the convenience of readers of the Journal and of those engaged in the chemical and allied industries generally. Anyone wishing information concerning any chemical product, or equipment, either as to source, price, method of packing, or transportation regulation, is invited to make use of this service. Write or telephone, and the desired information, if possibly available, will be given gratis.

THE SPECTROGRAPH IN METALLURGY

Adam Hilger, Ltd., London, Eng., are drawing particular attention to the accomplishments of their Quartz Spectrograph for metallurgical work. This spectrograph having a dispersive system made of quartz, gives, in addition to the visible spectrum, the very important ultra-violet region in which lie so many of the most distinctive metal lines.

INDUSTRIAL ITEMS

ALBERTA.—The Alberta Government and interested capital are understood to be considering the possibilities of establishing a pulp and paper industry in that province. Alberta has wooded areas, although the timber is small. Some experimental work will be necessary. The probable localities of the industry would be in the Peace River district with the idea of extension northward.

WELLAND—The Empire Cotton Mills, Ltd., are constructing a new addition to their plant at an approximate cost of $210,000. The new building, 75 x 264 feet, will be devoted entirely to weaving, and 150 new looms will be installed. and will be in operation by October 1st.

LONDON, ONT.—The London Bridge Works, a subsidiary of the Standard Steel Construction Co., Welland, Ont., commenced operations in June. Their plant has a capacity of 250 tons of fabricated steel for bridges and buildings. About forty men are employed. The Company intend to build and equip a large warehouse for the distribution of structural steel shapes, steel plates, bars, rivets, bolts, etc. T. J. Dillon is president, George M. Reid, vice-president, and J. J. Breen, secretary-treasurer, while directors are Philip Pocock, E. S. Little, Colonel Leonard, C. J. Madgett, and H. C. Baker.

TORONTO.—The Taylor Instrument Co. of Rochester, N.Y., have purchased a building at the corner of Church and Lombard Streets, where they have commenced the repairing and assembling of their instruments. The extent to which they will manufacture or assemble in Canada will depend upon the demand.

WELLAND, ONT.—The Welland Machine and Foundries, Ltd., have been taken over by the Lackawanna Tubes, Ltd. The new company have about 50 men employed, and the main product of the plant will be seamless steel tubes, not before manufactured in Canada. A new mill building, 80 x 400 feet, is under construction. L. R. Weeks of New York is president and general manager.

WALKERVILLE, ONT.—Jewett Radio-Phonographs, Ltd., capitalized at $1,000,000, will shortly commence the manufacture of radio receiving sets. E. H. Jewett, of Detroit, an active figure in the Paige-Detroit Motor Car Co. is president.

HALIFAX, N.S.—The foundry of Hillis and Sons, destroyed in the explosion of 1917 is being rebuilt. A main building 70 x 100 feet and two storey wing, 30 x 70 feet. The cost is estimated at $50,000.

HULL, QUE.—The B. & P. Laboratories, Ltd., capitalized at $50,000, commenced operations here recently in a two srotey plant, 70 x 40 feet. The products will be pure food, toilet and pharmaceutical preparations.

PETROLIA, ONT.—The Peninsular Sugar Company, Ltd., has been formed for the erection of a $800,000 sugar plant, manufacturing from beets. The daily output is expected to be 200,000 pounds. The plant is to be completed by September 15th, 1923.

SHAWINIGAN FALLS, QUE.—The Belgian Industrial Company are erecting an extra machine room to accommodate two new paper machines, the capacity of each machine being eighty tons of newsprint per twenty-four hours. For the present only one machine will be installed, and the estimated cost of the new building with one machine is $700,000.

DRUMMONDVILLE, QUE.—The National Silk Dyeing Company of Paterson, N.J., are erecting a plant covering about 80,000 square feet which will be operated by the Dominion Silk Dyeing & Finishing Co. Operations are expected to start early next year, including the dyeing of silk and artificial silk in the skein and the dyeing and finishing silk and silk-mixed goods in the piece.

LAKEFIELD, ONT.—Reconstruction of the plant of the Canada Cement plant is proceeding. Extensive alterations are being made and when completed the company will have practically a new mill with a capacity more than double the old plant.

HALIFAX, N.S.—The Premier Paper and Power Co. have purchased the H. Croix Paper and Lumber Co., including 26,000 acres of pulpwood and is planning the early construction of a new paper mill and power plant to cost $1,500,000.

MARYSVILLE, N.B.—Canadian Cottons, Ltd. announce that at the present time they have 50 per cent. more orders than a year ago.

THREE RIVERS, QUE.—With the Wayagamack Company, the St. Maurice Co. and the International Co. already established, and the St. Lawrence Paper Co's plant under construction, the potential output of paper from this district early next year will be about 800 tons a day, or 240,000 tons a year, in addition to about 130,000 tons of pulp. By the end of this month, the St. Maurice Co. will have its fourth machine in operation, making it one of the largest single paper mills on this continent with a newsprint capacity of approximately 340 tons per day.

INTERNATIONAL TO RESUME OPERATIONS

The announcement has been made that the International Nickel Company will resume smelting operations at Copper Cliff, Ont. shortly. Various superintendents and foremen have been notified to hold themselves in readiness for the reopening. Most of the miners who were employed at the Creighton Mine of the International previous to the close down are working in the gold mines in Northern Ontario.

The work of installing the machinery and equipment removed from the Bayonne, N.J. refinery of the International to the Port Colborne, Ont., plant is nearing completion. This move was made to carry out the company's policy of refining all nickel matte from Creighton in Canada. It should be stated that contrary to reports the refinery at Port Colborne never completely closed down and a steadily increasing amount of work is being done there.

REPORTS RECEIVED

The Carbon Electrode—This is the second edition of this little book—"The Carbon Electrode"—issued by the National Carbon Company, New York. It contains very much valuable data on carbon electrodes, and electric furnaces, and is compiled with the hope that the information recorded in convenient form, will assist the users of carbon electrodes in obtaining maximum service and efficiency. In addition to much practical information regarding the use of electrodes, there is also given a History of the Carbon Electrode and Electric Furnaces, and several pages of Formulæ and Tables for handy reference.

Thomas Broadbent & Sons, Ltd., Huddersfield, England—We are in receipt of two catalogues from this well-known British firm—Automatic Centrifugal Clutches, and Electric Capstans. The Broadbent Centrifugal Clutch was evolved to overcome the difficulty experienced in starting and accelerating a motor driving a load requiring a large starting torque, without the use of special switchgear, and with a minimum starting current. The clutch is particularly suitable for use with alternating current motors of the squirrel cage type, and is entirely automatic, the load being taken up gradually as the motor accelerates. The several designs of this clutch are adaptable to all types of drives. The catalogue is well illustrated, and tests on the clutch are included. Complete price lists are also given.

The catalogue on Electric Capstans describes fully the latest design of electric capstans for hauling purposes for use in railway yards, docks, industrial plants, etc. It is fully illustrated, and covers the subject thoroughly.

VALUABLE MAGNESITE DEPOSIT.

A new showing of Magnesite has been uncovered on the property of the International Magnesite Co., Limited, one of the Magnesite mining companies operating in the Calumet and Grenville districts. A sample taken over the surface of the new showing indicates that this new deposit is of high grade material and better quality than any of the other deposits opened in this district to date. The analysis of an average sample is as follows:

Silica	1.80 per cent.
Alumina and Iron Oxide	0.30 per cent.
Lime	5.15 per cent.
Magnesia	43.58 per cent.
Loss on Ignition	48.50 per cent.

If this deposit continues to depth it should prove of considerable value.

Chemical Oil and Metal Makrets

The Quotations Below Represent Manufacturers' and Wholesale Importers' Prices at Toronto, Montreal, or Other Canadian Points.

Chemicals.

July opens with business in chemicals considerably improved over a month ago. There has been a fairly steady increase in sales since June 1st and prices have remained remarkably firm. Indeed several lines have advanced. It is not to be expected that the market will remain just so active during all July and August as in June, as trade always slackens up somewhat during the summer period, but it is fully expected that even considering this feature, that a very fair amount of business will be done in chemicals all through the summer.

The demand from the various chemical using industries increased steadily all through June and is quite brisk at this writing (July 6th). The rubber, textile and leather industries are actively in the market, particularly the rubber and textile, while a healthy advance has occurred in the demand from the leather trade. One distributor states that they have done more business with the leather industry during the past three months than they did during the whole of 1921, and this is practically true of all chemical firms both at Toronto and Montreal.

Prices have remained steady in all the heavy chemicals, and several have advanced. In the pharmaceuticals, while advanced quotations are not as noticeable as in the heavy chemicals, yet on the whole, prices are firmer.

Advances—The following have advanced the amount noted: Alum, 45c per cwt.; Barium Chloride, three-quarters cent per lb.; Caustic Soda, ground, one-quarter cent per lb.; solid, one-half cent per lb.; Caustic Potash, 1c per lb.; Sodium Nitrate, refined, 25c per cwt.; Sulphur, roll, $1.75 per cwt.; Citric Acid, crystals, 10c per lb.; Coumarin, 50c per lb.; Oxalic Acid, 2c per lb.; Stearic Acid, double and triple pressed, 1c per lb.; Tartaric Acid, 5c per lb.

Declines—The following have declined the amount noted: Potassium Iodide, 20c per lb.; Chloroform, 20c per lb.; Glycerine (all grades) 1c per lb.

British Chemical Market.

According to special reports recently received by the British Trade Commissioner at Toronto, prospects in the British heavy chemical trade are better than they have been at any time since the beginning of the trade slump in 1920. Orders are being received in larger volume for many lines both from home and overseas. Continental supplies are not available in such quantities as was the case recently, and prices begin to show a tendency to advance.

The United Alkali Company's Ammonia Soda Works' extension, started in December last, is working satisfactorily and the product is well absorbed by the market, or by the subsidiary plants for caustic soda and soda crystals, which are at present working at full capacity. The electrolytic plants at Newcastle are working almost full, but similar plants at Widnes are still on reduced load, as the demand for chloride products (bleaching powder, etc.), is still far below normal. The position is, however, said to be improving week by week.

The demand for sulphuric acid, which has been poor, is now steadily improving and efforts are being made by the manufacturers to effect substantial price reductions to the consumers.

In coal tar intermediates business continues on quite steady lines, but more interest is noticeable on export account. The improvement in coal tar products has been maintained, especially for creosote and carbolics.

Metals.

The increased activity noted in the metal trades during May and early part of June has been well maintained. Quotations have remained fairly steady. Increased construction work has kept a nice business going in fabricated steel. The demand for lead has been particularly encouraging. Copper has maintained the advance of last month though no further advances are expected immediately. The wire mills continue to take the bulk of the copper, though increased sales are noted to brass manufacturers and sheet mills. The coal strike has had an adverse effect on the zinc market as the galvanizers, the principal buyers, fearing a tie-up, are not stocking any more zinc than they actually need for present work. In spite of this, the quotations on zinc have kept fairly steady.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.95— 5.15
Ammonium Bromide	Lb.	.. — .38
Aluminium Sulphate, bags	100 Lbs.	.. — 2.50
Aluminium Sulphate, iron free	Cwt.	.. — 4.50
Ammonia, Aqua, 26, Carboys	Lb.	.. — .14
Ammonia, Aqua, 26, Drums	Lb.	.. —.09½
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb	.. — .14
Barium Sulphate (Barytes)	Pre Ton	30.00—35.00
Barium Chloride	Lb.	.05— .07
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb.	.. — .26
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	.02½— .03
Borax, crystals	Lb.	.07⅛—.07¼
Boric Acid, powdered	Lb.	.. — .13
Bromine (technical)	Lb.	.. — .38
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —95.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	..—100.00
Calcium Chloride, fused	Per Ton	36.00—38.00
Calcium Chloride, flake	Ton	40.00—42.00
Caustic Soda, ground, drum	Cwt.	6.00— 6.25
Caustic Soda, solid, drum	Cwt.	5.00— 6.00
Camphor Monobromate	Lb	.. — 3.00
Carbon Bisulphide, in drums	Lb.	.. — .11
Carbon Tetrachloride, drums	Lb.	.19— .20
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, imported	Per Ton	20.00—25.00
Cobalt Oxide, black	Lb.	.. — 2.00
Cobalt Oxide, grey	Lb.	.. — 2.25
Copperas (Iron Sulphate) crystals	Lb.	.02—.02¼
Copperas (Iron Sulphate) sugar	Lb.	.02—.02¼
Copper Sulphate (Blue Vitriol)	Lb.	.07—.07½
Corrosive Sublimate (Mercuric Chloride)	Lb.	.. — 1.10
Fluorspar, ground	Tons	.. —30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.11— .12
Ferric Chloride, solution	Lb.	.. — .10
Hydrofluoric Acid, 60%	Lb.	.. — .28
Hydrofluoric Acid, 30%	Lb.	.. — .13
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	.70— .75
Iodine, crude	Lb.	.. — 4.50
Iodine, resublimed	Lb.	.. — 5.25
Iron Oxide (red)	Lb.	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.14 — .15
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.09— .10
Lithium Carbonate	Lb.	.. — 1.70
Lithopone	Lb.	.06— .07
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl	Lb.	.09— .11
Magnesium Sulphate	Lb.	.03— .04
Mag. Sulphate, B.P., Medicinal	Single Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Muriatic Acid, 18	100 Lb.	2.75— 3.00
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt.	Lb.	.. —.16½
Nickel Salt, double, barrel lots	Lb	.. — .15
Nickel Salt, double, per cwt.	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lb.	.09—.09¼
Phosphoric Acid, 85%	Lb.	.. — .28
Phosphoric Acid, 50%	Lb.	.. — .22
Phosphorus, yellow	Lb.	.. — .34
Potash Prussiate, yellow	Lb.	.28— .30
Potassium Bicarbonate	Lb.	.. — .20
Potassium Bromide, crystals	Lb.	.22— .30
Potassium Bromide, granular	Lb.	.22— .30
Potassium Bichromate	Lb.	.. — .25
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .09
Potassium Chlorate	Lb.	.. — .10
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .80
Potassium Hydroxide (caustic potash) small drums	Lb.	.20— .22
Potassium Hydroxide (caustic potash) large drums	Lb.	.09— .11
Potassium Iodide	Lb	.. — 3.95
Potassium Nitrate, casks	Lb.	.. — .10
Potassium Permanganate, bulk	Lb.	.65— .70
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. — 9.00
Soda Ash, bags	Cwt.	2.25— 2.40
Sodium Acetate, ton lots or over	Lb.	.. —.06½
Sodium Acetate, lesser amounts	Lb.	.. —.07½
Sodium Benzoate	Lb.	.75— .80
Sodium Bicarbonate, 100% pure	Lb.	2.50— 3.00
Sodium Bichromate, bbls	Lb.	.10— .13
Sodium Bisulphite, powder	Lb.	.. — .06
Sodium Bisulphite, 35	Lb.	.05½— .06
Sodium Bromide (foreign)	Lb.	.30— .35
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. — .31
Sodium Hyposulphite, kegs	100 Lb.	5.85— 6.00
Sodium Hyposulphite, barrels	Cwt.	5.25— 5.50
Sodium Iodide	Lb.	.. — 4.60
Sodium Nitrate, refined	Cwt.	6.75— 7.00
Sodium Nitrate, crude, 95%	Cwt.	5.00— 5.75
Sodium Nitrite	Lb	.12— .15
Sodium Peroxide, f.o.b. New York	Lb.	.30— .35
Sodium Silicate, 42°, car lots	Cwt.	.. — 1.40
Sodium Silicate, 42°, smaller lots	Cwt.	.. — 1.60
Sodium Silicate, 40°, car lots	Cwt.	.. — 1.30
Sodium Silicate, 40°, smaller lots	Cwt.	.. — 1.50
Sodium Sulphate (Glauber's Salts) crystals,		
	Per Cwt. in Bags	1.90— 2.00
	Per Cwt. in Car Lots	1.65— 1.70
Sodium Sulphite	Lb.	.. — .05
Sodium Prussiate, Yellow	Lb	.18 — .19
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	5.75— 6.00
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars		23.75—24.00
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Ton	.. —23.00
Tin Chloride crystals	Lb.	.30— .35
Tri-sodium Phosphate	Lb.	.08—.08¼
Ultramarine, Blue	Lb.	.15— .35
White Precipitate (Mercuric-Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	.. —30.00
Whiting (American)	Ton	.. —30.00
Zinc Sulphate, com.	Lb.	.05—.05¼
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.10—.11½
Zinc Stearerate	Lb.	.. — .75

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TABLE OF CONTENTS

EDITORIALS:

Page
Chemistry Measured Annually 169
Summer Meetings in Canada 169
Between the Upper and Nether 169
A Remarkable Opinion 170
The Effect of Chemicals on the Ignition Temperature of Wood
By W. O. Banfield and W. S. Peck . . . 172
The Absorption of Gasoline From Natural Gas
By R. C. Cantelo . . . 177
The Linseed Oil Industry in Canada 179
Canadian Baking Industry 179
Notes on the Detection and Estimation of Small Amounts of Platinum and Palladium in the Presence of Large Amounts of Silver
By C. A. Knittell 179
Canadian Malt Liquor Industry 180
Page
Manufacture of Black Pigments
By H. L. Blachford 180
Annual Meeting, Society of Chemical Industry . 183
Canadian Pacific Section, Society of Chemical Industry 183
New Books 184
Investigations Under Way by the Mines Branch, Ottawa 185
World Conditions and News in Chemical Fields 186
A Conference on Ontario Iron Ores 187
Mining and Metallurgy in British Columbia . 188
New York Chemical Exposition . 189
Catalogs Received 190
Market Review 191
Market Prices 191
Buyer's Guide 43
Index to Advertisers 52

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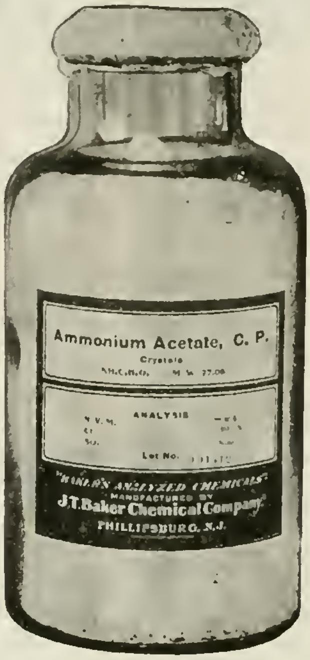
Dependable Reagents—



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EDITORIALS

CHEMISTRY MEASURED ANNUALLY

THE National Chemical Exposition has come to be an American Institution. Some see it every year; others less frequently; and it is the plan or ambition of all chemists to visit the show. The Eighth Exposition finds itself back in Grand Central Palace, New York City, which is central indeed for most of America.

The Exposition is the visible evidence of national progress, made possible through the co-operation of some four hundred companies, whose products and service stand behind the industries of the nation.

From the national viewpoint, the progress of chemistry in the United States has not the same personal stimulation as may be received from activities within the Dominion, but Canadians are not blind to the fact that the industrial activities of our neighbors, along scientific lines, mean the more rapid development of our own country. Therefore, from the business standpoint, the event in New York is as significant for industry in Quebec as it is for business in California.

The Chemical Exposition is putting chemistry on a business basis, and is the greatest single factor operating in America to give the public a balanced conception of the function of the modern chemist in the industrial world.

We strongly urge all our readers who can, to take advantage of the incalculable stimulation to be received by attendance at meetings and the close study of exhibits.

SUMMER MEETINGS IN CANADA

WE have noted with much appreciation the growing popularity of Canada as a Summer meeting-place for scientific and technical organizations.

In June we had a flying visit from the American Institute of Chemical Engineers, and the Summer meeting of the American Leather Chemists' Association at Bigwin Inn, up Muskoka way.

The American Ceramic Society will spend the week of August 13th, to 18th in a trip, starting at Rochester, to Montreal, Ottawa, Kingston, Toronto, Hamilton and Buffalo, and the American Electro-Chemical Society will visit Montreal and Shawinigan, September 21st and 23rd.

These visitors are welcome, and more than that. They represent in the best sense the goodwill and neighborliness of the folks in America Street, and we hope soon to have all the fences down between lots, even if there remain some necessary formalities with reference to property lines to keep the naughty boys in check.

These visitors not only see our points of interest, but they open the eyes of our own folk. From the scientific point of view, Canada is extremely interesting.

The distribution and size of our water powers, coal, oil and minerals with their topographic and geologic relationships are not appreciated as much as they should be perhaps, by the folks at home.

You know how it is when you've sweated about in your back yard trying to make a garden, or grow anything at all, and one of your neighbors comes in and says he's heard you have a great bed of asters or wants to know how you grew such fine tomatoes, your heart warms right up to him, of course, but that is not all. Your own folks will take a little more interest in it too.

So we feel that these visits are thrice blessed. We hope to have many more of them, and do a little visiting ourselves, because we have found that these good guests are jolly good hosts.

We'd like to have a summer meeting of the American Chemical Society up in the Temagami Lakes and spend a week getting acquainted, without having to run through a brick yard, or walk in and out of endless laboratories, or slide round a packing house in our visiting clothes.

BETWEEN THE UPPER AND NETHER

PROFITS and wages have heretofore been the two chief considerations in coal and transportation. The vicious game of tag between operators and wage earners has followed its own law of supply and demand, supply of profits and demand for wages. Each time one tags the other, the general public squeezes a sweaty hand into its jeans and "everybody loses" as Ikey said of the church collection.

We are not making out a case for public ownership, but we do believe in the public right to see that fuel and transportation, whose costs enter heavily into everything we wear, eat, or live in are obtained without the reckless waste of raw material and human endeavor that have characterized these two great industries.

Coal is getting to a stage wherein exhaustion can be more approximately calculated every year, especially anthracite; yet the mines running and the people dependent upon them in the United States, would, if working full time the year round, produce about 200,000,000 tons more than the present consumption.

The result of this condition coupled with the seasonal requirements is an alternation of hard work and idleness that is undermining the morale of the whole industry, operator and miner alike.

A committee called the "Public Committee on the Coal Strike," has been sitting in New York, prepared to hear suggestions and bring to public notice facts bearing on the situation. Before this committee, appeared, Hugh Archbald, industrial engineer who says:—

"We are isolated, we bituminous miners. You cannot realize how far out of touch we are with your world. I am one of the few engineers in the coal industry and it's because there are so few of us engineers that there is such a great waste. The thing, you see, is a vicious circle. Intermittent work makes it impossible for the operators to employ high-salaried engineers.

"In many of the working places, the roof is no higher than the tops of those chairs. If you were to spend the day crawling around this room with a pick in your hand, working in quarters that did not permit you to raise your head above a four-foot level, your strained muscles would tell you what it means to work in the mines. And, when you realize that intermittent employment implies weeks of loafing and softening of muscles, then you will understand what waste of man power occurs when men are constantly coming up from mines to take a rest, and other men are constantly going down to take their places. Again, intermittent work means cheap foremen and lack of organizing ability underground.

"The largest of our engineering societies could find time for but one afternoon's discussion of the coal industry at a conference held just before the strike. Coal engineers are so few and far between as to have little voice in the proceedings of the engineering bodies of the country. But does anyone think that coal is an unimportant element in our civilization?"

Dr. George Otis Smith, of the United States Geological Survey, speaking of the waste and inefficiency of the coal industry, said it was "A cause of humiliation and shame." and he expressed astonishment at the opposition of the operators to any fact finding agency, which might presumably put the industry on a better scientific plane.

On the other hand we find the Union strongly out for a commission of experts to get at facts, not to arbitrate a wage controversy but to approach the problem in a scientific way involving research and engineering. The miners have lost faith in a "public representative" having the view that he usually sides against them, but they are quite ready for a commission of experts, whereas the operators are not.

To us at a distance it would seem as if what is needed is a diversion of about half the population, now trying to subsist on mining to some other line of endeavor, and the operation of mines continuously, which is easily said, of course.

The anomaly is that the miners are represented as wanting science and the operators as preferring darkness to light.

The miners complain of public indifference, but they do not realize that the public pays the bill not the operators or the dealers. If the miners engaged experts and got the best in the country, they would not spend anything like so much as this strike will have cost, and they would have the public behind them if the facts warranted it. As it is, the public attitude is "a plague on both your houses."

A REMARKABLE OPINION

THERE has been a very fair amount of reasonably sensible opinion appearing lately in some of the longer articles in the daily press relating to national research along industrial lines, and the particular question of centering activities at Ottawa. It remained, however, for the "Vancouver Sun," in a recent issue, to advance certain ideas which we feel indicate a crudity of conception hardly in line with the estimation scientists have of their own work. It is argued that Germany maintained armies of research workers by paying them little and awarding them with degrees and titles. By this means, according to this paper, was she able to gain a lead on the rest of us. "Under this system," we quote direct, "German manufacturers were satisfied if only five per cent. of the research workers discovered anything." What a delightful picture of scientific slavery! We can almost imagine the ceremony of giving degrees to the five who discovered "anything" and the grim shooting of the ninety-five at sunrise because they did not discover "anything."

The world needs to have its attention focused on the hopelessly slow way in which fundamental scientific advances and efficiency methods are applied to manufacturing processes, the arts and sciences. The unfortunate idea that research of value is only for rich and large organizations, and if attempted at all must be on a gigantic scale, is illustrated by the remainder of the same editorial which we quote in full:

> "United States manufacturers, rich and with ramifications extending into many industries, can afford to maintain research workers and pay them well by driving them to the limit of their capacities. How is Canada to meet this condition?
>
> "The Council of Industrial Research proposes to establish

a Bureau at Ottawa to investigate Canadian by-products and utilize the knowledge gained in Canadian industries.

"But the problem of remuneration to workers will still be the same. Before the discoveries begin to pay for themselves the cost of maintaining a sufficient force of trained scientists will be immense. There is one and only one solution.

"The Bureau should be established and given the power of conferring advanced scientific degrees. Post-graduate students in science from Canadian universities could take their advanced work in Ottawa just as well as in the United States, England and Germany. Their work could be original but directed along certain lines to make for co-ordination of endeavor. With such a system in operation, Canadian industry would be stimulated and supported by a strong force of research workers, costing the Canadian people nothing more than the price of experiment materials and annual convocation to confer degrees, and Canadian industry would gain the scientific knowledge, monopoly of which is the secret of trade domination."

A little knowledge is evidently a dangerous thing, and sometimes may be the cause of mirth. The sad feature of the case is that this newspaper is trying to help a situation it cannot evidently comprehend. Unless we are mistaken, here is a writer struggling hopelessly with matters which are beyond him. As for "The Vancouver Sun," we would suggest that they secure the assistance of any one of the several good chemical writers we have in Vancouver, whose services could be had, no doubt, according to this theory, if a title were specially created and a few Latin verses quoted while they held hands in the editor's office. Seriously, we seem to see an opportunity for chemists here. If they wish to secure publicity, of a sane sort, why not seek to attach themselves to the staffs of our leading dailies, and undertake to supervise such effusions, occasionally putting in a few stories with the points well sharpened and set, so that they strike home in a sound constructive way. Space rates and some fun might be had in this way.

What we need first in Canada is the organized application of established scientific data applied in a business way to our various industries. If we developed and applied the ideas of research workers in other countries as Germany always did, we would not be far behind.

We need to keep the research springs open and running, but dividends come from the application in all factories of all our industries of those methods of working and controlling processes which have been shown to be standard practice elsewhere, or under our conditions. Our industries ed both co-operative applied science and research, [illegible] careful scientific management. [illegible] Duff, to pick out

properly. He is making chemistry count on the right side of their balance sheets and they know it. They appreciate in a new way the wonderful truth that there is a mild type of industrial research which is just common sense, applied in little ways that they never had been trained to think about.

The idea is now too prevalent that a degree will do in lieu of bread and butter, and that industrial research in the hands of the Government or elsewhere can in some way be run on the cheap, as far as the salaries of those who carry the burden are concerned.

CHEMOR, CHEMISTOR, CHEMICOR

In connection with our editorial in July on possible distinguishing names for chemists, we have had two other suggestions. One is "Chemistor," and the other "Chemicor." If anyone has further suggestions, we would be glad to hear of them. If the idea has any merit, surely a new country like Canada could lead off in helping, to this extent, the development of our personal chemical nomenclature.

If publicity is our aim, let us first secure something to advertise—a distinctive name for instance.

HOW GERMANY SEES THE POTASH SITUATION

The Alsatian potash deposits will be worked by a single joint-stock-company; in the board of directors of this company the French state will be represented by three members, experts on agricultural, mining and finance.

At present, Germany is possessed of 206 potash mines, Alsace of seventeen mines. Nine-tenths of the world's production is absorbed by the agricultury, one-tenth is consumed for industrial purposes. In 1913 the consumption of the world, amounted to one million tons pure potash, one-half of which was consumed in Germany, one-fourth in the U.S.A., the rest in France, England, Holland, Belgium and other countries.

Within the following years of keen competition between Germany and Alsace only one-half of the world's market is free to France and the U.S.A., will be the chief consumer.

The Alsatian production of potash could be increased to 400,000 tons pure potash, whereas rhe French consumption at present could be 100,000 tons. 300,000 tons, or 75 per cent. of the Alsatian output therefore has to be taken up by foreign markets—in strong competition with German potash—or by the French domestic market in consequence of propagated higher consumption.—From a Special Report to Canadian Chemistry and Metallurgy from Berlin.

ONTARIO ASSISTING PROSPECTORS

The Deputy Minister of Mines is announcing that the Temiskaming Testing Laboratories, Cobalt, which is owned and operated by the Ontario Government, will accept parcels of gold ore from 100 pounds upward. The shipper will receive [illegible] In this way, it

The Effect of Chemicals on the Ignition Temperature of Wood[*]

Results of Experiments Carried Out at University of British Columbia---A Search for a Practical Fire Retarding Chemical

By W. O. Banfield and W. S. Peck

WOOD has its many uses,and fills a place in the commercial world as no substitute can. As a result of this, there have been many efforts to make wood fireproof, or to use a more correct term, fire resistant, for such a material as wood could hardly be rendered fireproof.

The possibility of thus treating wood, dates back as far as 1820, when a Bavarian chemist used sodium silicate. Later, Gay Lussac investigated the subject and experimented with borax and ammonium salts, and also the chlorides of sodium, potassium, calcium and magnesium. He also studied the characteristics of the various chemicals used, and divided them into several classes

1. Substances which on heating, leave an infusible earthy residue, and so cover and protect the combustible fibres of the wood.
2. Substances which fuse at a moderate temperature, and coat the fibres with a glassy protective material.
3. Volatile salts which on heating, give off a gas which is non-combustible.

The question has always been more or less in the minds of those who are interested in promoting the use and sale of wood, and wood products, and thus recently, J. H. Coderre[1] experimenting in the Forests Products Laboratory of Canada, stipulates the following conditions which any substance used for fire protection must fulfill.

1. Relative to the degree of protection, the substance used must be cheap.
2. It must be reasonably effective at low concentrations.
3. It must be insoluble in water, if it is to be used under atmospheric conditions.
4. It must not be volatile under the ordinary conditions of temperature.
5. It must prevent the formation of glowing coals which would start a second fire.
6. It must not be corrosive to metals.
7. The application must be made in one treatment, and on green timber if possible.

He also states that the salts ammonium phosphate, ammonium sulphate and aluminium sulphate have fireproofing qualities, but would not be used because of their solubility. One suggestion he gave was, to first impregnate with calcium chloride, then with ammonium phosphate, forming calcium ammonium phosphate which is insoluble in water. This means a double treatment, which would make the process expensive.

The National Fire Protective Association in their Bulletin 1916, tables No, 16 and 17, gave the following general conclusions with regard to their experiments;

1. There is little variation in the inflammability of specimens of untreated wood, tested at high temperature.
2. The ammonium salts and sodium borate gave the best results. All others are useless, or destroy the wood.
3. No chemical prevents it from glowing or charring.
4. Shingles may be made fire retardant by certain water soluble chemical salts that require subsequent painting.
5. Insoluble borates precipitated in the wood are the most practical.
6. Paints with zinc borate as a pigment were very effective.
7. Shingle stains do not make shingles more inflammable.

Tests for Inflammability

Gardner in his book, "Paint Research" gives the four following tests for the comparison of treated woods:

1. FLAME TEST:
   The specimen is placed over a three-inch hole in a 1/8-inch asbestos board, and held in place by two 1 kgm. weights, placed one on each side of the hole. The flame of a bunsen burner is used, and the tip of the flame allowed to impinge on the specimen for one minute. The relative effect on treated and untreated specimens is noted.
2. TORCH TEST:
   The specimen is inclined at 45 degrees and the tip of a bunsen flame allowed to strike the wood at a point six inches from the desk, and the effect on treated and untreated specimens is noted before.

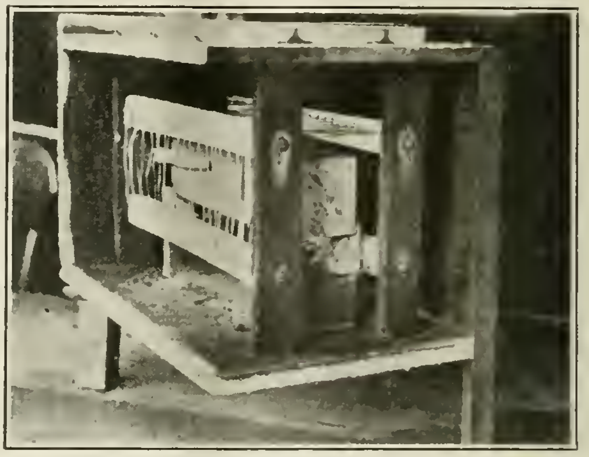

Fig. 1
The Furnace with one side and the door removed to show the construction and position of pyrometer in relation to the wood.

3. CINDER TEST:
   This consists of heating a 13/16 x 13/16 x 3/8-inch iron nut for two minutes on a wire gauge, supported so the tip of the bunsen flame just touches it. The nut is then placed on the specimen until cold, no deep charring should result.
4. FIRE TEST:
   A 5/8-inch strip of the specimen is treated with the exception of two inches at one end. It is held horizontally, and the untreated end ignited. The specimens should be slowly revolved to expose all faces equally. The flame, on reaching the treated portion should go out.

The test decided upon for these experiments, was one which would imitate as far as possible a condition in actual practice, and consisted in raising the temperature about the specimen, until it burst into flames.

This test is at best, but a relative one, for no standard conditions could be laid down without great detail, and a complexity of apparatus.

For this purpose, the furnace shown in the photograph (Fig. 1) was built of asbestos board. It was screwed together with brass machine screws, the windows at the side were of a clear mica, held by the four cleats. The heating element was built of two circuits of nichrome resistance ribbon, 1/8 x .010-inch, supported on asbestos pieces, which were in turn screwed to four end posts, and so fastened to the outside shell of the furnace. The two circuits were connected to a 110-volt, direct current supply, and took approximately 15 amperes each.

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[*] This work was carried out at the University of British Columbia, under the direction of Prof. E. H. Archibald.

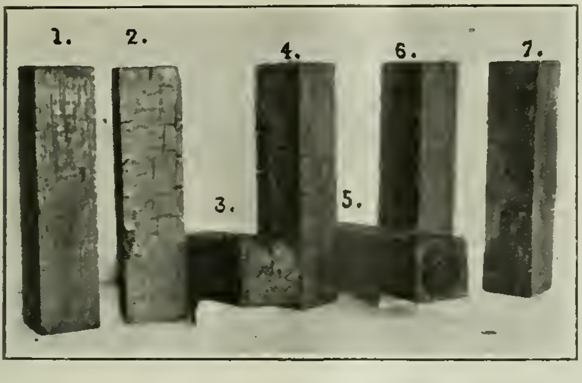
[1] Canada Lumberman, March 1, 1922 page 44.

The specimen was supported on two asbestos supports, which were so shaped as to hold it equidistant from the heating coils on each side, and at the top and bottom. Air was supplied through six one-inch holes on the bottom of the furnace, and the gases were allowed to escape through similar holes on the top of the furnace. These were placed, so an equal distribution of air was given over the length of the specimen, the amount supplied, being regulated by dampers which could be closed over the holes. A pyrometer was placed in the furnace in as close proximity to the wood as possible, in order to read the temperature of the surface of the wood. The temperature was read directly on the instrument in centigrade degrees.

Preparation of Sample:

The specimens used were entirely British Columbia Douglas Fir, that were cut up into samples 2 x 2 x 8 inches in size, when smooth finished. These were dried at 90° C., in an electric oven, to constant weight, to the nearest half gram.

The specimens were then numbered, the weight of each was noted, as well as the solution with which each was impregnated. After treatment, the sample was again dried to constant weight, thus giving the change in weight in grams, due to the impregnation. The specimen was then tested.



(FIG. 2)

SOME OF THE TESTED SPECIMENS

The centre five were impregnated with ammonium phosphate. The two outside ones were not impregnated.

	1	2	3	4	5	6	7
Amount of Salt absorbed, gms.		9.5	25	15	7	8	
Ignition Temp., Cent. Deg....	308	375	348	370	370	310	302

This also shows the manner in which the salt comes to the surface on heating, and how badly the wood cracks before ignition.

Preparation of Solutions:

The salts used were usually soluble in water. The solutions were made in varying quantities, and kept in large bottles until needed. Various strengths were used, the main object being to place as much of the solid salt in the specimen as possible.

Methods of Impregnation:

Practically four methods of impregnation were used:

1. By immersing the specimen in the solution, and leaving it for various periods of time, allowing the dried wood to absorb the solution.
2. By immersing the specimen in a boiling solution for a certain period of time. This method had to be used with some salts which were not very soluble, at a lower temperature. Alum was such an one.
3. By placing the specimen in a closed pipe, and putting the solution in under pressure of between 50 and 60 lbs. per square inch. This pressure was maintained for a definite period of time.
4. Procedure 3 was changed, in that a vacuum was made in the pipe containing the specimens, and was maintained for five minutes, the solution was then sucked in, and a pressure of 50 to 60 lbs. placed on the pipe as before.

The first and second methods varied but little in their results. The second method did very little towards making the wood absorb more; really it only made possible the use of comparatively insoluble salts.

Methods three and four gave much better results; as many as 125 grams of solution being placed in some specimens in three hours. The fourth method was the best, in that it removed the air from the cells in the wood before the solution was applied so gave it an opportunity to enter the pores of the wood. By this last means a high concentration of the salt was placed in the wood in one impregnation.

Method of Testing:

The furnace was always previously heated. It was found not to give consistent results when one specimen was run from a cold furnace, and the next one was run shortly after. When run from a cold furnace, the walls absorbed considerable heat, and so caused a longer time to elapse before the specimen reached its ignition temperature than it would if the furnace was previously warmed. It was therefore always heated to 350° C. before the first specimen was run each day, and then allowed to cool to the temperature used as the starting point. This temperature was taken as 100° C. more or less arbitrarily. The specimen was then placed on the supports in the furnace, and the door closed. The photograph (Fig. 1) shows the furnace with one side removed, and the position of the pyrometer, relative to the wood. The ventilators were left wide open, as preliminary tests had proved to be advisable. The current was turned on. The rate of rise of temperature is shown by the graph (Fig. 3), where, for the case of magnesium chloride solution the rise of temperature in degrees is plotted against time in minutes. This heating was continued until ignition of the specimen took place. The ventilating holes were then closed, the current turned off, and the flames were soon smothered.

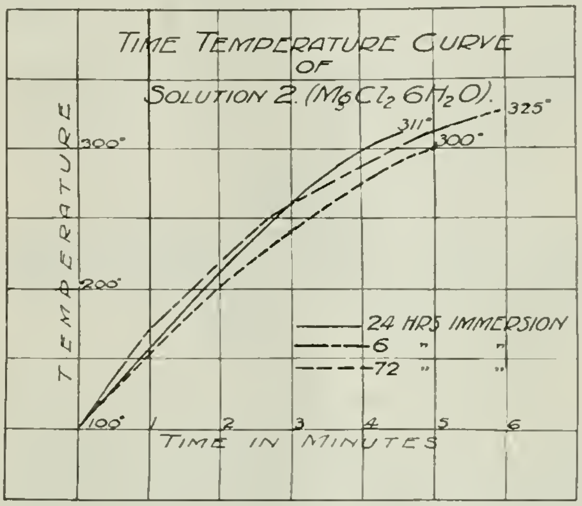


FIG. 3

Graph showing rate of temperature rise for magnesium chloride solution.

Results of Tests:

The solution used varied considerably in concentration and character. Many chlorides were tested, as well as sulphates, phosphates and silicates. Each solution will be discussed separately.

1. ZINC CHLORIDE: (.5 Normal)

Average Ignition Temperatures:
320.3° Impregnated by immersion.
295° Impregnated by pressure.
335° Impregnated by pressure and vacuum.

The action may in part be due to the fact that heat would be absorbed by the water of crystallization that is driven off. Hydrogen chloride is given off by the salt on being heated, and would thus have a diluting effect on the gases from the wood. The samples after impregnation were of dark color which would affect paint detrimentally. This solution is one which is used quite widely as a preservative.

2. MAGNESIUM CHLORIDE: (Six Molecules of Water of Crystallization). (.5 Normal)

Average Ignition Temperature:
311° Impregnated by Immersion.

This salt on heating, decomposes, giving off its water of crystallization and hydrogen chloride which would affect the ignition temperature similarly to zinc chloride. The magnesia coats the surface of the wood, thus preventing ignition. The loss in weight of one of the specimens tested, shows that some soluble compounds in the wood were removed by the impregnation.

This salt, and the one following, are similar in their decomposition products, and the effect on the ignition temperature.

3. CALCIUM CHLORIDE: (Six Molecules of Water of Crystallization). (.5 Normal).

Average Ignition Temperature:
312° Impregnated by Immersion.

This salt decomposes into calcium oxide and hydrogen chloride at high temperature. These two products with the water of crystallization have a slight effect on the ignition temperature.

4. CUPRIC CHLORIDE: (.5 Normal).

Average Ignition Temperature:
270° Impregnated by Immersion.

On being heated cupric chloride loses water and hydrogen chloride, and becomes an oxy-chloride. The anhydrous salt, if present would lose chlorine and forms an oxy-chloride with the oxygen in the cells of the wood. There is also a catalytic action taking place here. This is probably the reason why these specimens ignited at such a low temperature. This solution removed some of the soluble salts from the wood, leaving it lighter in weight, and a dirty brown in color.

5. AMMONIUM CHLORIDE: (.5 Normal).

Average Ignition Temperature:
297° Impregnation by Immersion.

Ammonium chloride decomposes at 350 degrees, which is above the ignition temperature of the wood. The little protection afforded is due to its inert behavior at the ignition temperature.

6. BISMUTH TRICHLORIDE: (.3 Normal).

Average Ignition Temperature:
265° Impregnation by Immersion.

In the case of this salt, an oxychloride of bismuth will form, which would make impregnation difficult.

The oxychloride heated in air loses chlorine and takes up oxygen, but heated out of contact of air, it fuses and does not decompose. The presence of air in the wood cells promotes the formation of bismuth oxide. This probably tends to lower the temperature of ignition.

7. FERRIC CHLORIDE: (Six Molecules of Water of Crystallization). (.5 Normal).

Average Ignition Temperature:
284° Impregnation by Immersion.

The salt is hydrolized in solution giving an acid reaction. It has a slight lowering effect on the ignition temperature, which is probably due, as in the case of cupric chloride, to its catalytic action.

8. SODIUM CHLORIDE: (.5 Normal).

Average Ignition Temperature:
295° Impregnation by Immersion.

This salt would not decompose within the range of temperature of tests, so its action would be that of an inert chemical. This effect is negligible.

9. AMMONIUM SULPHATE: (Twice Normal).

Average Ignition Temperatures:
316° Impregnation by Immersion.
317° Impregnation by Pressure.
349° Impregnation by Pressure and Vacuum.

This salt melts at 140° and decomposes at 280°, forming ammonia and ammonium acid sulphate. The evolution of this gas tends to dilute the oxygen in the cells of the wood, and so retard the ignition. The results indicated that the higher the concentration of the salt the higher the ignition temperature.

10. AMMONIUM PHOSPHATE: (Twice Normal).

Average Ignition Temperatures:
298° Impregnation by Immersion.
350° Impregnation by Pressure.
344° Impregnation by Vacuum and Pressure.

This salt was looked on with favor because it tends to gather water and so keep the wood damp. It will give off ammonia on being heated, leaving ortho phosphoric acid, which melts at a low temperature, and covers the fibres of the wood. The acid decomposes at 213° into water and phosphorus pentoxide. All these actions are accompanied by the absorption of heat, and this would tend to keep the specimen below its ignition temperature. The results show that the higher concentrations of salts give the best results which would be expected from the nature of the reaction.

The photograph shown in Fig. 2 illustrates the manner in which the salt comes to the surface during the heating, and also shows how checked and cracked the specimen becomes. The end views of the specimens give a fair idea of how deeply the solution penetrates the wood as shown by the amount of salt on the surface of the wood. There are two untreated specimens one at each end of the illustration which show the relative effect of the heating on treated and untreated samples.

11. BORAX, OR SODIUM TETRA BORATE: (.29 Normal)

Average Ignition Temperature:
307.5° Impregnation by Immersion.

A solution of this salt is strongly alkaline, and removes some of the compounds from the wood which was shown by the coloring of the solution after immersing specimens in it, and also by the loss in weight of one of the specimens. The salt comes to the surface and forms a glassy coating over the fibres which does not allow the oxygen of the air to reach the wood.

The combination of borax and zinc chloride was tried,
specimens being dried after each immersion. The
desired was the formation of the insoluble zinc
wood.

Average Ignition Temperature
338° Impregnation by Pressure.

The specimens were impregnated
accounts for the high amounts absorbe
that some good effect was obtained.
absorbed showed that quite a good
have been present. Zinc chl and
along with the zinc borate,
have their separate effect on od.
advantage of being insoluble i ater, and co
impregnating wood exposed to the elements

12. BORACIC ACID:

Average Ignition Temperature
299° Impregnation by Immersion.

This salt melts at 185°, and it would
with a glaze which would permit the
to escape, but would not allow the oxyg

TABLE I.
RESULTS FROM IMPREGNATION BY IMMERSION

Solution	3 Hours Immersion			6 Hours Immersed			24 Hoors Immersion			No. of hrs. immersed	Time	Weight	Temp.
	Time	Weight	Temp.	Time	Weight	Temp.	Time	Weight	Temp.				
1	4-40	6.0	312°	5-25	—1.0	315°	6-00	—3.5	334°				
2	5-20	1.0	308°	5-45	3.0	325°	4-33	—5.0	311°	72	5-00	1.0	300°
3	5-16	2.0	326°	5-00	2.0	320°	5-45	2.5	302°	72	5-00	—1.0	301°
4	4-00	0.5	265°	3-10	—3.0	260°	2-50	—4.0	285°				
5	6-00	3.0	300°	5-28	7.0	300°	4-40	1.0	290°				
6	3-06	2.0	252°	4-15	7.0	282°	4-06	—1.5	262°				
7	3-20	3.0	300°	4-25	6.0	295°	4-20	2.0	265°	48	4-10	2.0	275°
8	4-30	—6.0	271°	4-30	4.0	295°	5-20	2.0	315°	48	5-20	5.0	298°
9	4-30	1.0	310°	5-00	—1.0	300°	4-47	2.0	312°	48	5-35	—1.0	298°
										96	4-30	2.0	315°
10	4-00	0.0	290°	4-00	0.5	312°	5-05	1.5	292°				
11	4-25	1.0	320°	4-30	—3.0	320°	5-00	1.0	295°	24	4-40	2.0	295°
12	3-35	—1.0	305°	5-15	0.5	302°	4-30	—4.0	290°				
13	4-52	1.0	292°	4-20	8.0	285°	3-42	0.0	290°				
15	5-26	—4.0	318°	5-42	1.0	320°	5-20	—2.0	328°				
16	3-30	0.0	270°	3-34	3.0	271°	3-48	2.0	290°				
17	2-20	—2.0	220°	2-33	0.0	242°	2-50	1.0	260°				
14*	3-00	8.0	225°										
	3-00	4.0	265°										
	4-30	6.0	295°										
	2-00	3.0	200°										

The time is expressed in minutes and seconds, and is the time the specimen is heated before flame.
The weight is the number of grams the specimen gains or loses during the treatment.
The temperature is the number of degrees centigrade at which the specimen spontaneously breaks into flame.
*The specimen was kept in boiling solution for three hours.

with the wood and burn. It melts at a much lower temperature than borax, possibly at too low a temperature, and would then be too fluid unless in great concentration to be of value at the temperature of 300 degrees. It did not prove to have any possibilities in the tests.

13. ALUMINIUM SULPHATE: (18 Molecules of Water of Crystallization). (.25 Normal).

Average Ignition Temperature:

289° Impregnation by Immersion.

This salt is decomposed on heating, giving off its water of crystallization, and being reduced in the presence of the carbon of the wood, forms the oxide. This formation of aluminium oxide is exothermic, and would tend to raise the temperature of the wood, which accounts for the low temperature of ignition. A water solution of this salt is strongly hydrolized, the acid present destroying the wood fibres.

14. POTASSIUM ALUM: (24 Molecules of Water of Crystallization). (.302 Normal).

Average Ignition Temperature:

246° Impregnation by Immersion.

This salt on heating, melts at 84½° in its water of crystallization, which is later evaporated, and the alum then becomes spongy in appearance. The porosity has the effect of opening the pores of the wood to the air, and results in the specimen igniting at a lower temperature. This particular solution had to be hot while the wood was being immersed because of the low solubility of alum at ordinary temperatures.

15. SODIUM SILICATE: (.5 Normal).

Average Ignition Temperature:

322° Impregnation by Immersion.

The sodium silicate on heating comes to the surface of the wood, and covers the fibres with a glaze which prevents the oxygen of the air from aiding combustion. It raises the ignition temperature of the wood considerably. The solution being strongly alkaline tends to dissolve some of the soluble compounds in the wood.

16. BARIUM CHLORIDE: (2 Molecules of Water of Crystallization). (.5 Normal).

SULPHURIC ACID: (.5 Normal).

Average Ignition Temperature:

277° Impregnation by Immersion.

In this case the wood was first impregnated with barium chloride, and then with a solution of sulphuric acid forming a precipitate of barium sulphate in the wood. The salt is infusable at low temperatures, but with carbon, can be reduced to barium sulphide and oxygen. This would rather lower the temperature of ignition which is proved from the tests. In the impregnation the acid affects the texture of the wood detrimentally.

17. STANNIC CHLORIDE. (.5 Normal).

Average Ignition Temperature:

241° Impregnation by Immersion.

This salt hydrolizes to hydrochloric acid and stannic hydroxide. The hydroxide decomposes within the range of temperature of the tests, and the oxide forms which has a catalytic action on the wood, and explains the low temperature of ignition. This solution also affects the wood fibres, the hydrochloric acid being responsible.

18. ZINC AMMONIUM PHOSPHATE:

Average Ignition Temperature:

320° Impregnation with Vacuum and Pressure.

When impregnating the wood in this case the ammoniacal solution is forced into the wood, and the excess ammonia is driven off to some extent by the heat used to dry the wood, leaving zinc ammonium phosphate. On heating the specimen in the furnace the ammonia is driven off, leaving zinc pyrophosphate. The heating continues until the wood carbonizes, and we then have the reducing effect of the carbon on the phosphate. The tests show that the heat used to break up the salt and the incombustible gas given off, raises the temperature until the wood carbonizes sufficiently to reduce the phosphate, we then have ignition.

19. There was a combination solution tested, consisting of:

107	Grams of Ammonium Sulphate.
22	Grams of Ammonium Phosphate.
5.6	Grams of Sodium Phosphate.
5.6	Grams of Borax.
700	Grams of Water.

Average Ignition Temperature:

303° Impregnation by Immersion.

These various salts have been considered and the discussion need not be repeated. It is interesting to note, however, that the average of the ignition temperatures of the above solutions impregnated separately 304.5 degrees which shows that each chemical acts separately, and there is no additive effect in the mixing of solutions.

In Tables I. and II., the results obtained as outlined above, are set forth. The several values will be clearly understood from the descriptions of the units under Table I.

From the results of the experiments, the tests can be divided into three groups according to the temperature of ignition.

TABLE 11.
Results from Impregnation under Pressure and under Vacuum and Pressure.

Solution	Pressure 50-60 lbs. per square inch for 3 Hours			Vacuum and Pressure 50-60 lbs. per square inch for 3 Hours		
	Time	Weight	Temp.	Time	Weight	Temp.
1	3-23	3.0	300°	18-00	2.0	495°
	4-00	2.0	300°	4-10	2.5	280°
	3-32	4.0	285°	6-00	1.0	325°
				4-30	4.0	330°
				4-30	4.0	325°
				6-00	2.0	360°
9	4-47	8 0	332°	5-00	6 0	320°
	4-29	0.0	305°	5-25	5 0	375°
	5-20	—2.0	315°	7-10	24 0	378°
10	6-43	7.0	370°	6-50	7.5	348°
	4-00	8.0	310°	6-30	9 5	375°
	9-30	5.0	370°	4 30	7.0	310°
18				4-30	2.0	326°
				4-30	3.0	315°
				3-46	4 0	320°
11 and 1	6-20	5 (1) 2 (11)	375°	3-45	1 (1) 0 (11)	300°
	5-00	7 (1) 0 (11)	342°	4-35	8 (1) 2 (11)	332°
	6-00	7 (1) 2 (11)	360°	4-00	2 (1) 2 (11)	312°

AVERAGE TEMPERATURES FROM ABOVE RESULTS

Solution	Pressure	Pressure and Vacuum
1	295°	335°
9	317°	349°
10	350°	344°
18	....	320°
1 and 11	359°	315°

The nomenclature is the same as in Table 1.

1. Those that burn below 290 degrees, or fire promoters.
   In this class are cupric chloride, bismuth chloride, ferric chloride, alum, barium sulphate and stannic chloride.
2. Those that burn between 290 and 300 degrees and have little effect on the wood. In this class are ammonium chloride, sodium chloride, borasic acid, and aluminium sulphate.
3. Those substances that burn above 300 degrees, and have a fire retarding effect. In this class are zinc chloride, mixture of phosphate and borax, magnesium chloride, calcium chloride, ammonium sulphate, ammonium phosphate, borax, sodium silicate, and zinc ammonium phosphate.

The various substances used could be classified according to their behaviour under the conditions of the experiment.

1. Those substances which owe their effect to the water of crystallization have little effect. The magnesium and calcium chloride and aluminium sulphate are of this class. They also decompose, giving an incombustible gas. These are of very little value as a means of raising the ignition temperature of wood.
2. Those substances which formed an infusible residue in the wood. The calcium chloride and magnesium chloride would come under this head, as well as under No. 1. These, also, are of little value.
3. Those substances which fuse and protect the wood from the oxygen of the air, borax, boracic acid, and sodium silicate. The effect is favorable in some cases. The salts must be in fair quantity to form a sufficiently thick coating over the wood.
4. Those substances which decompose into incombustible gases. The chlorides as a rule give off hydrogen chloride which does not have a very great effect, as it is not present in sufficient quantities to dilute the combustible gases so that they will not ignite.

There were one or two chemicals in which were combined two or more of these characteristics. Ammonium phosphate is the one which stands out prominently in that it gives off an incombustible gas, ammonia, leaving ortho phosphoric acid that melts and covers the fibres of the wood, it therefore has quite a noticeable effect in raising the temperature of ignition. This salt was the best of those tested.

Conclusions

The results of the tests, and a study of the subject have brought out many points to be considered in the search for a fire retarding chemical to be applied to wood, if the wood is to be used as building material. These points could be enumerated as follows:

1. The salt must not attract water too much, or the wood will always be damp.
2. It must not affect the tools of the workman, and also any metal fittings applied to the wood.
3. It should not be poisonous in case a splinter should enter a person's hand.
4. It should be fairly effective at low concentrations.
5. It should not be volatile at ordinary temperatures, nor soluble if used for outside work.
6. It should penetrate easily.
7. It should not affect the strength of the wood, nor affect any decorative coating applied over the wood.

From the foregoing, it would seem that the search for a practical fire retardant chemical is beset with great difficulties, for those salts that are readily obtainable fail in one or more of these seven conditions.

The subject will bear considerable investigation, of which the above work is merely a start.

Laboratory of Engineering Chemistry,
University of British Columbia, Vancouver, B.C.
June 1, 1922.

REGULATIONS FOR THE PURCHASE OF ALCOHOL BY RETAIL DRUGGISTS

Under date of June 27th, the Government issued new regulations allowing licensed druggists to secure alcohol at a reduced rate of Excise Duty for the preparation of prescriptions for medicines and pharmaceuticals.

The amount of alcohol available for this purpose is limited to five gallons per month, or an amount specially arranged for with the Minister.

Theoretically, the alcohol may be purchased from the Government Vendor a wholesale distributor or the distiller. In the first two cases, a $9 duty is charged, and a rebate given to make the duty correspond to that paid if bought direct from the distiller, which would be $2.40.

As the arrangement is working, it is not likely that much business will be done directly with distillers, and they probably do not specially desire to seek this business in any event. The druggist will continue to buy as before from the wholesale distributor, who is able to render him this service more economically than a distant distiller. In order that the druggist may take advantage of this, a license must be had, a bond for $1,000 given, and a rebate secured in some cases, all for the privilege of using five gallons of alcohol in a very special way each month at a reduced Excise Tax.

Southern Market for Caustic Soda

Chile and various South American countries are becoming increasingly large users of basic chemicals. The business in caustic soda appears to be divided between England and the United States, in about the proportion of two to one. It is stated that the nitrate producers are much interested in research on iodine, with a view of expanding the market. The possible production is many times any present market. Reports indicate that the Bethlehem Steel Co. has rented certain areas in Northern Chile, with a view to shipping very large tonnages of iron ore to the United States.

The Absorption of Gasoline from Natural Gas—I[*]

Methods of Testing Natural Gas for Gasoline Content—Theory and Development of Absorption Process Outlined.

By R. C. Cantelo

IT has been estimated that the production of gasoline in the United States will be unable to exceed the demand for more than five or ten years.[1] This impending shortage of motor fuel can be relieved not only by the development of new sources and substitutes for this fuel, but also by the application of scientific principles to the prevention of waste in those processes of production which are already in existence.

During the last ten years an important source of gasoline has been "casing-head gas." This term is used to describe the gas accompanying an oil in an oil well. This gas contains considerable amounts of ethane, propane and butane, and also some of the vapors of the gasoline liquids, pentane, hexane and heptane. The method employed in the preparation of casing-head gasoline commercially depends upon refrigeration and compression.[2] Common practice is to use a two-stage compression, the first stage from 25 to 50 lbs., and the second from 120 to 150 lbs. per square inch, cooling with water at ordinary temperature. The gasoline recovered is too volatile for the ordinary uses to which this material is put, and is exceedingly dangerous to handle. It is therefore blended with low-grade naphtha to produce a motor spirit with the desired proportion of lighter hydrocarbons, thus rendering the blended product suitable for uses to which the heavier naphtha could not be put. The recovery of this liquid during recent years has become a matter of considerable industrial importance. In the United States, the production of casing-head gasoline reached some 43,000,000 gallons in 1914, and in 1915 represented about 10% of the total American gasoline production.[3]

The compression and refrigeration method of extracting gasoline from natural gas is profitable only with "wet" gas, i.e., gas which is in intimate contact with oil, and contains more than one gallon of gasoline per 1,000 cubic feet of gas. For the treatment of "dry" natural gas (gas not intimately associated with oil), the absorption process has been developed. This process consists in the absorption of the gasoline vapors from natural gas by means of a heavy oil, and by it, natural gas yielding one quart of gasoline per 1,000 cubic feet of gas, or even less can be treated profitably where the quantity of gas is large enough to give an amount of gasoline more than sufficient to pay the cost of maintenance.

Occurrence of Gasoline in Natural Gas

Analysis of natural gas from all parts of the world have shown that it consists principally of a mixture of paraffin hydrocarbons along with small proportions of nitrogen, carbon dioxide, hydrogen sulphide, water vapor and helium.

Ordinary eudiometric methods of gas analysis determine only the total paraffin hydrocarbons present, but fractional distillation of natural gas at low temperature by means of liquid air[4] has shown the presence of the higher hydro-carbons—butane to heptane.

Methods of Testing Natural Gas for Gasoline Content[5]

These are summarized very briefly below:—

1. A determination of density, usually by Bunsen's "effusion method,"[6] together with the analysis. The error of the effusion method is considerable[7], but it is quite accurate enough for the purpose.
2. Solubility Tests of the gas in oil or alcohol. The oils used are usually "mineral seal" and "claroline." By comparing the solubility of new samples of gas with the results obtained on other samples which represent gas from which gasoline can be profitably extracted, the gasoline content of the former can be estimated.
3. A laboratory method consists in subjecting the gas to a temperature of about—115° C., by means of liquid air, and then pumping away as much of the gas as possible by means of a vacuum pump. This procedure fractionates the gas into two parts—(a) the gasoline which remains in the liquefaction bulb, and (b) the natural gas that is pumped away. The refrigerant is then removed from the gasoline, and the latter allowed to evaporate when its partial pressure is measured. This pressure is proportional to the volume of gasoline vapor contained in the original sample. It has been found that 1% of gasoline as shown by this method corresponds to a yield of 1 pint of gasoline per 1,000 cubic feet of gas.
4. Actually determining the gasoline content of the gas, by passing a measured volume of gas through an absorbent oil contained in a small portable absorber. Recently, a form of absorber has been devised[8] in which charcoal is used as the absorbent. At the end of the test glycerol is added to the charcoal in a distilling flask, and the amount of gasoline is determined by distillation.
5. In the testing of "wet" gas to determine its suitability for use in a compression gasoline plant, it is usual to make actual tests with a small portable plant, consisting of a gas-engine, compressor, meter and cooling coils mounted on a truck. In this way, a well can be tested simply by moving the compressor to the casing-head.[9]

Natural Gas in Canada

The preliminary report on the Mineral Production of Canada, for 1916, published by the Mines Branch, Department of Mines, Ottawa, states:—

> "The total production of natural gas, according to returns received, was 25,238,568 thousand cubic feet, valued at $3,924,462. The production by provinces was as follows:—Ontario 17,838,318 thousand cubic feet, valued at $2,730,653; New Brunswick 610,118 thousand cubic feet, valued at $79,628; and Alberta 6,818,131 thousand cubic feet, valued at $1,114,531."

It is evident, therefore, that Ontario, New Brunswick and Alberta are potential sources of natural gas gasoline. The only work on the testing of Ontario's natural gas for gasoline content, is, to the writer's knowledge, that carried out by Ellis, Bain and Ardagh, at the University of Toronto.[10] By fractionally distilling the gas at low temperature, they were able to prove the presence of propane in a number of wells in Western Ontario. A search of the literature has revealed no figures for the content of higher hydrocarbons for New Brunswick natural gas.

The important Alberta natural gas fields viz.:—Medicine Hat, Bow Island and Viking fields were in 1918 tested for their gasoline content at the instance of the Canada Power Board. In addition, the casing-head gas of the Dingman Wells, of the Calgary Petroleum Products, Ltd., at Okotoks, was also tested. The writer was associated with Dr. D. B. Dowling in this investigation.

Medicine Hat and Bow Island gases gave no yield of gasoline; the gas of the Viking field gave yields varying from 0.03 pints of gasoline per 1,000 cubic feet of gas for Well No. 6, to 0.1 pints per 1,000 cubic feet of gas for Wells No. 1 and No. 4.

The results of the tests on Wells No. 1 and 2 of the Calgary Petroleum Products, Ltd., are given in the following table.

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[*] This is Part I. of article. Part II. (concluding) will appear in September issue.

TABLE I

Test No.	Well No.	Absorbent Used	No. of Absorbers	Total Gasoline Obtained Pints per 1,000 cu. ft.	Specific Gravity of Recovered Gasoline
1	2	Mineral Seal	1	1.7	
2	2	Mineral Seal	2	2.0	0.696
3	2	Kerosene	2	3.0	0.723
4	2	Kerosene	2	3.0	0.720
5	2	Mineral Seal	1	3.7	0.703
6	1	Mineral Seal	2	1.8	
7	1	Mineral Seal	2	2.3	0.697

It is of interest to note here that the Calgary Petroleum Products, Ltd., were in 1919 extracting gasoline from their No. 1 and No. 2 wells.[11] The yield of gasoline from the two wells amounts to about 1.2 gallon per 1,000 cubic feet.[12]. It should be noted that the values given in Table I, for the gasoline content per 1,000 cubic feet of gas, are for the gas measured at atmospheric temperature and pressure (50-60° F. and about 26″ of mercury).

Theory of the Absorption Process

The theory of the absorption process may be most easily understood by considering the extraction of one vapor only from the natural gas, e.g., pentane. When the gas is passed through the oil absorbent, the concentration which the pentane can reach in the absorbent, is, at a given temperature, determined by the partial pressure of the pentane in the gas. In other words, the pentane dissolves until its vapor pressure from the solution is equal to its partial pressure in the gas.

As natural gas bubbles through the heavy oil absorbent, each constituent vapor dissolves in the gas until its vapor pressure from the solution is equal to its partial pressure in the gas. When this point is reached, no further solution of the constituent takes place. It does not follow, however, that the oil becomes saturated with each constituent at the same stage of washing. This is an important point, and it is possible, by an application of this principle, to extract only the important gasoline vapors, pentane, hexane and heptane.

Development of the Absorption Process

The absorption process for gasoline is very similar to the extraction of the aromatic hydrocarbons from coal gas. In this process, the gas is made to flow counter-current to the wash oil which absorbs the vapors in the gas. The liquid hydrocarbons are then recovered from the absorbent by distillation. The process for the extraction of gasoline differs from that applied to coal gas, chiefly, in that it is frequently necessary to carry out the absorption under high pressure, as it is necessary not to disturb the pressure on the pipe line system.

Young[13] described a process forty-five years ago which is identical with that used for extracting gasoline from natural gas to-day. His apparatus consisted of a tower with an upper compartment containing coke. Oil descending through the coke met the gas travelling upward, and removed the hydrocarbon vapors. The oil then passed into the lower part of the tower where the vapors were distilled off by steam.

In the United States, attention seems to have been drawn in 1906 to this process for extracting gasoline from natural gas. At this time we find Hastings and Brink's patent applied for on December 10, 1906.[14] This covers an apparatus for removing gasoline under pressure. This consisted of a reservoir to contain a cooling fluid, a number of headers arranged in the reservoir, cooling pipes connecting the headers, expansion chambers in the pipes of greater diameters than the pipes, means for discharging the liquid condensed in these chambers, and water spraying tubes arranged centrally around the pipes provided with perforations for directing jets of water transversely across the pipes in the path of the stream of gas. The inventors also claim the use of oil instead of water.

Von Groeling[15] in an English patent issued in December, 1909, claims in part as follows:

1. "A process for the utilization of natural gas or petroleum distillation gases—by quantities—of an absorption medium for instance heavy benzine, the unabsorbed gases being condensed by the use of high pressure and low temperature.
2. An apparatus for use in carrying out the process set forth in claim (1) in which the gas is treated in a series of absorption apparatus arranged one behind another . . . , with absorption medium."

Saybolt,[16] in an American patent, issued April 18, 1911, specifies a similar process, together with the process of recovering the gasoline from the menstruum, by distillation.

Snees' patent,[17] 1915, describes a method for "discharging all the liquid and gaseous hydrocarbon products of an oil well into a liquid or gas container, and absorbing the gaseous hydrocarbons which accumulate within the container above the surface of the liquid."

The first large-scale absorption gasoline plant seems to have been built at Hastings, W. Va., and it began operations in 1913.[18]

The greatest amount of experimental work on the extraction of gasoline from natural gas has been done by officers of the United States Bureau of Mines. The following synopsis of their work on the absorption process is from the Summary given in United States Bureau of Mines, Bulletin 120, page 65.

"Tests were made with a plant of fairly large proportions capable of handling 15,000 to 30,000 cubic feet of gas per hour. The principle feature of the plant consisted of an absorber where the natural gas and absorbent oil were brought in contact with each other, a heat exchanger where the oil with its absorbed gasoline was heated before going to the still, a steam still where the gasoline was extracted from the oil, a cooler where the hot oil from the still was cooled before receiving another charge of gasoline, pumps and a weathering tank.

"Several different types of absorbers were tried. The one giving the best results consisted of a tower filled with pebbles, in which the oil flowed downward and the gas upward.

"An increase in the temperature of the oil in the absorber from about 15° F. to about 85° F. lowered the gasoline yield about 0.3 pint per 1,000 cubic feet of gas. An increase in the pressure of the gas from the atmospheric pressure to 110 pounds per square inch increased the yield from 0.7 pints to about two pints of gasoline per 1,000 cubic feet of gas.

"The specific gravity of the gasoline obtained, varied between 77° and 85° B. The boiling point ranged from 80 to 300° F. The evaporation loss was about 11 per cent. in 24 hours as compared to 2.4 per cent. from a 'straight' refinery gasoline having a gravity of 60.4° B. The vapor pressure of the gasoline ranged from one pound at 70° F. to about five pounds at 100° F.

"The absorption process can be profitably operated at low pressures."

To the writer's knowledge the only work carried out in Canada on this subject has been that of Dowling and himself in 1918. As tests have shown the extreme dryness of the Alberta Gas Fields, it is to be hoped that the natural gas of Ontario and New Brunswick will be tested soon for its content of higher hydrocarbons.

The writer quoted from a Mines Branch Report, "The production (of natural gas) by provinces was as follows:

"Ontario 17,838,318 thousand cubic feet. . . ." If this gas contains one pint of gasoline per 1,000 cubic feet of gas there would be extracted over 17,000,000 pints of gasoline per year. At twenty cents a gallon, the total value of the gasoline saved would be nearly 20% of the value of the natural gas produced in the province in a year.

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(To be Continued)

THE LINSEED OIL INDUSTRY IN CANADA

The Dominion Bureau of Statistics, Ottawa, has issued a report on the Linseed Oil Industry in Canada, during the years 1919 and 1920. The report covers eight mills for each year, located as follows: Quebec 3; Ontario and Manitoba, 2 each; and Alberta 1.

The quantities and values of products manufactured in this industry during the years 1919 and 1920 are shown in the following summary. The value of products shows an increase of $1,149,977 in 1920. Raw linseed oil increased to $2,627,265 gallons in 1920 from 2,536,332 gallons in 1919. Boiled linseed oil was reported at 769,899 gallons in 1919, as against 798,975 gallons in 1920.

Items	1919		1920	
	Quantity	Value	Quantity	Value
Linseed oil, raw, Imp. gal....	2,536,332	$4,499,361	2,627,265	$5,502,846
Linseed oil, boiled, Imp. gal..	769,899	1,361,443	798,975	1,577,335
Special oils, gal.............	237,721	431,093	....	....
Oil cake and meal, ton........	23,072	1,455,509	....	....
All other products...........	....	2,332,701	....	2,149,903
TOTAL VALUE..........	....	$8,080,107	....	$9,230,084

The total capital invested in the industry in 1919, was $2,358,062, and in 1920, $2,911,634. The increase of $553,572 is attributable to increased holdings of stocks.

The increased production in 1920 is reflected in the higher total payroll of the industry, which increased from $281,989 in 1919 to $306,068 in 1920. The total value of all materials utilized by the industry was $6,921,801 in 1919, and $7,180,011 in 1920. The quantity of flax seed used and pressed in 1919 was, 1,637,991 bushels, and 1,527,096 bushels in 1920.

In 1920, 15,680 lbs. of Fullers earth was used. The value of other materials used in refining in 1920 was $377,263.

In 1920 there was a marked increase in the quantity and value of linseed oil imported into Canada. In 1919, 2,465,522 lbs., valued at $544,986 were imported, as compared with 8,323,183 lbs. in 1920, valued at $1,987,252.

CANADIAN BAKING INDUSTRY, 1920

According to a report issued by the Dominion Bureau of Statistics, covering the Canadian Baking industry, as distinct from the Biscuit and Confectionery industry, there were 1,769 individual baking plants in Canada, in 1920. The total value of products by the industry was $61,800,633, of which amount, the bread made, was valued at $51,564,995. The total capital invested in the industry was $23,612,654. The total cost of materials used by the industry during the year, was $38,259,135, of which $29,655,484 was for flour; $1,064,775 for yeast; $1,778,632 for sugar; $1,753,596 for lard; $334,026 for malt; $118,860 for salt; $219,942 for butter; $810,468 for eggs; $57,072 for extracts and essences; and $34,114 for glucose.

RUBBER IN INDIA

India has over 800 rubber plantations, with an area of some 200,000 acres. Some 45% of this is in Burma. The annual production runs over 13 million pounds, practically all of which is Hevea. The business gives employment to over 40,000 people, with the United Kingdom taking over 75% of the output.

NOTES ON THE DETECTION AND ESTIMATION OF SMALL AMOUNTS OF PLATINUM AND PALLADIUM IN THE PRESENCE OF LARGE AMOUNTS OF SILVER

By C. A. Knittel

About two years ago the writer did some work on anode slimes, resulting from the electrolytic refining of silver recovered by smelting ores from the Cobalt district. The presence of metals of the platinum group was suspected, and the method for the estimation of platinum and palladium may prove of interest to chemists who might be called upon to determine minute amounts of these metals under similar conditions. No originality is claimed for the scheme presented, its principal feature being the separation of the platinum, etc. from the bulk of the silver by means of fractional precipitation with H_2S water as proposed by Dewey.[1]

The slime (assaying about 800 fine) was heated to a dark red in order to decompose nitrates and organic matter, then fused with one-fifth its weight of borax glass. The resulting button was freed from adhering slag and again fused in a shallow roasting dish in an oxidizing atmosphere. When the surface of the molten silver was covered with a film of oxides, some borax glass was added and the heating continued until the oxides were taken up by the molten borax. The fusion was allowed to cool, the slag removed by hammering, the silver again fused and granulated by pouring into water.

200 grams of the granulated silver (now about 990 fine) was parted with a mixture of 200 c.c. of conc. HNO_3 and 600 c.c. of water. The acid was allowed to act at room temperature until most of the silver was dissolved, then heated to boiling until all nitrous fumes were expelled. The whole was allowed to settle for twelve hours, and the supernatant solution removed by decantation. The residue was treated a second time with 400 c.c. of (2:1) HNO_3, allowed to settle, decanted, and washed with water. The gold was digested with dilute (1:5) aqua regia at a temperature of 50°C. It dissolved without leaving any residue, and the solution was evaporated to dryness on the water bath. The residue was taken up with dilute HCl, and again evaporated to dryness to remove the last traces of HNO_3. The dry chloride was taken up with a few drops of HCl and about 200 c.c. of water and the solution kept in a dark cupboard over-night. A small quantity of AgCl which had separated, was filtered off. To the clear filtrate a few more drops of HCl were added, and the gold precipitated with SO_2. The gold was filtered on dense double papers, ignited and weighed. The gold recovered weighed 439.5 m.g. The clear filtrate from the gold was evaporated to fumes with the addition of 1 c.c. of conc. H_2SO_4, taken up with 10 c.c. of water, filtered, then saturated with H_2S under pressure. No change was produced in the solution by this treatment.

The two parting acids and the washings were evaporated in order to expel most of the free acid, then diluted to a volume of about three litres. A fractional precipitation was now made by adding 75 c.c. of strong H_2S water, drop by drop, with continual stirring. The whole was stirred from time to time for a few hours, then allowed to settle over-night. The supernatant solution was syphoned through a dense filter paper, the precipitate transferred to the filter, thoroughly washed with hot water, dried, carefully ignited, scorified and cupelled. The resulting bead weighed 1032 m.g.

The bead was parted with 20 c.c. of (1:1) HNO_3, 10 c.c. of conc. H_2SO_4 added, and evaporated to fumes of SO_3. The sulphates were dissolved in water, diluted to about 150 c.c., and allowed to stand over-night. A minute amount of gold was separated by filtration, and the filtrate caught in a 600 c.c. beaker. The filtrate was diluted to 400 c.c., and a fractional precipitation made with 5 c.c. of saturated H_2S water which had been diluted to 50 c.c. The whole was allowed to stand with frequent stirring for several hours, then filtered, washed, dried, ignited, scorified and cupelled. The resulting bead weighed 68.6 m.g. and was parted with 5 c.c. of conc. H_2SO_4. The sulphates were taken up with 25 c.c. of water, boiled and allowed to settle. The dark insoluble residue was filtered off, washed with water, then with a hot solution of ammonium acetate, ignited, digested with a few drops of HNO_3, washed and again ignited. It weighed 0.38 m.g. and its identity as platinum was confirmed by micro-chemical tests.

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[1] Trans. Am. Inst. Min. Eng., 43, 578.

The filtrate from the platinum amounting to about 60 c.c. in volume, was partially neutralized with 5 c.c. of conc. NH_4OH, then 5 c.c. of a 1% solution of dimethylglyoxime were added. After about 15 minutes, the characteristic color of the palladium compound of dimethylglyoxime appeared. The whole was allowed to stand until the precipitate had coagulated. The precipitate was filtered off, washed, redissolved in a few c.c. of HNO_3, and evaporated to fumes with 1 c.c. of conc. H_2SO_4. The sulphate was taken up with 10 c.c. of water, one drop of very dilute HCl added, and allowed to stand in the dark for a considerable time. A minute amount of AgCl was removed by filtration, the clear filtrate saturated with H_2S under pressure, and allowed to stand under pressure overnight, filtered, washed and ignited. The ignited metal was warmed with a few drops of formic acid, dried and weighed. The metal weighed 0.32 M.g. and micro-chemical tests proved it to be palladium.

Needless to say scrupulous cleanliness was observed throughout the various operations, and "blanks" were run on all chemicals and filter papers used. No doubt these platinum metals occur in extremely minute amounts in the ores of the Cobalt district, and in this case had become concentrated in the slimes incidental to the refining of many million ounces of silver.

THE CANADIAN MALT LIQUOR INDUSTRY

During 1919 and 1920, there were 57 breweries in operation in Canada, according to a report recently issued by the Dominion Bureau of Statistics, Ottawa, located as follows: Alberta 5; British Columbia 13; Manitoba 5; New Brunswick 2; Nova Scotia 1; Ontario 20; Quebec 10, and Saskatchewan 1. The total capital invested in the industry in 1919 was $28,119,447, and in 1920, $37,494,396.

An increase of $9,526,785 is reported in the value of brewery products in 1920 over the preceding year. The quantity of beer, ale, etc., in barrels, shows a decrease, though there is an increase in value. Bottled liquors increased by 5,199,635 gallons, and the value reached $20,227,059 in 1920. The total value of beer, ale, stout and porter was reported at $19,122,837 in 1919 and at $28,588,622 in 1920, an increase of $9,465,785. The total value of all products increased from $20,169,074 in 1919 to $29,695,859 in 1920.

The largest outlay for materials was made for malt, costing $6,188,300 for 2,113,924 bushels in 1920, and $3,912,966 for 1,440,819 bushels in 1919. The total cost of materials was reported at $8,093,403 in 1919 and at $12,525,107 in 1920, an increase of $4,431,704. The cost of bottles also increased from $1,589,983 in 1919 to $2,590,284 in 1920, a difference of $1,000,301.

Of the materials used in 1920, there were 48,100 lbs. of anhydrous ammonia, valued at $21,000; 609,183 lbs. of carbonic acid gas valued at $51,048; 103,561 lbs. of calcium chloride, valued at $3,213; and 111,210 lbs. of common salt, valued at $1,343.

The value of imports into Canada of malt liquors in 1920 more than doubled that of 1919. In 1919, 47,498 gallons valued at $63,173 were imported, as compared with 72,838 gallons in 1920, valued at $131,615. The exports from Canada also increased tremendously in 1920, 756,381 gallons, valued at $859,364 being exported in 1920, as compared with 241,994 gallons, valued at $157,150 in 1919.

Manufacture of Black Pigments

By H. L. Blachford

(Continued from Last Issue)

Uses of Carbon Black

Use in paint, etc.

a. Mixed Paints: The ordinary grades of Carbon Black are advantageously used in tinting paints of all colors, and also in dead black paint, although for the latter work more intense carbon blacks are usually used.

b. Enamels: The same applies here as under mixed paints, with the exception that the higher grade carbons are more widely used.

c. Varnishes: The very intense Carbon Blacks are now coming into very wide use in the better grade varnishes, very often in conjunction with drop or ivory drop blacks. The carbons are found to be very valuable here, as the most intense grade super-spectra, is as black as the drop blacks, and in addition is many times stronger, and will not settle out of solution.

d. Japan Colors: The darker shades can be obtained effectively by tinting with ordinary grades of carbon black and the dead black color is obtained with the higher grade carbons.

e. Black Japans: The basis of this material is Asphaltum, and the black color so obtained can be intensified by adding the high grade carbon blacks.

We see from the above that by the proper use of the different grades of carbons, suitable tints in blacks can be obtained for all classes of work. The only exception is in the case where a blue under-tone is required, here lamp black must be used.

Use in Printing Ink

Here as in the case of paint making, a number of distinctly different carbon blacks are prepared for the trade. The ordinary grades are used for news inks, better grades for book and job inks, other grades are required for half tone inks, finally a grade is produced for lithographic ink. The lithographic black is the highest grade black produced for the printers, and is valuable not so much for its intensity of color, but because it is prepared in such a way as to make it soft to the touch, and when ground in oil it has the property of making mixtures long, i.e., stringy. This black is known as Peerless Black, and on account of the properties outlined above, it is universally used in making lithographic inks, carbon paper, and typewriter ribbons.

Use in Rubber

Here the color of the carbon black is a secondary consideration and it is invaluable because it is the finest of all pigments, regardless of color. The rubber industry had for some time been looking for finer pigments, for it was known that the finer the material the rubber was combined with, the greater the strength and toughness of the resulting product. Up to the time of this discovery carbon black has only been used in footwear and other black stocks, to give them their black color.

As the rubber companies installed testing apparatus, and the microscope came into more general use for examining compounding materials, it became evident that carbon black was the ideal material for which they had been looking. Carbon black was then added to the rubber in much greater quantities than was necessary to color the product, and tests were made with automobile tires, footwear, and in fact everything in the rubber line which was subject to wear or abrasion. So successful were these tests that there is more carbon used by the rubber industry to-day than all the other users together.

Tires so compounded give twice or more than their former mileage, and rubber footwear lasts proportionately longer when carbon black is added in sufficient quantities. We should add here, that the specific gravity of carbon black is 1.7, so that where costs are figured on a volume basis, as in the case of the rubber industry, it is a very economical pigment to use. The black for the rubber trade usually comes in the compressed form which effectively prevents flying when ground on the open mills.

Use in Paper Making

A special brand of carbon, known as Paris Black is used in making black, grey, or for tinting the different colored paper. The black is so intense and uniform that it is by far the most economical black the paper makers use.

In addition to the above, we can say without fear of contradiction, that in any other of the many places where it is convenient or advisable to use a pigment black, carbon black is almost invariably used.

LAMP BLACKS

There are two different kinds of lamp black. One is known as flame black, and the other, lamp black proper. The first black is made by burning solid or semi-solid materials, such as rosin, asphaltum, osokorite, etc., in a kiln with a limited supply of air. The smoke so formed is led through a duct into a series of chambers where the black settles out on the walls, ceilings, and floor, and is collected from time to time, the first chamber nearest the kiln will contain the heavier particles which will be slightly oily in nature, the next chambers will contain the better grades.

LAMP BLACKS PROPER: These are made from various bi-products from the distillation of coal, petroleum, fish oils, light and heavy tar oils, and vegetable oils, both fresh and rancid. The rancid oils give a slightly better product than the fresh oils.

These liquids are burned with an insufficient supply of air, in especially constructed burners. The flame in the more up-to-date factories, impinges on a water-cooled rotating metallic surface, and the black so formed, is scraped off on the other side of the cylinder, as it revolves. The greatest danger in connection with the manufacture of lamp black is the difficulty in keeping the product free from oily materials, for in spite of the great progress made in its manufacture, uniformity in the amount of oily matter is very difficult to obtain.

The method of purification of lamp blacks is carried out by placing an iron box, filled with lamp black in a kiln, and heating it to a red heat. A small opening is left in the box for the vaporous products of distillation to come off. For the best lamp blacks, five or six calcinations are necessary.

USES IN PAINT AND VARNISH: Lamp black is the most generally used tinting black for obtaining greys. This is due to its characteristic blue undertone, which makes it invaluable for this class of work. Unfortunately, however, it is a slow drier, owing to the amount of oil it often contains. The above use is almost the only one in which it is desirable or economical to use lamp blacks in the paint industry, carbon blacks being blacker, as well as considerably stronger, and usually cheaper, are more efficient.

MANUFACTURE OF BONE BLACKS

The bones are secured from various sources, such as the stock yards, local butcher shops, and garbage collectors. They are dried and then calcined in kilns or retorts, at a temperature which varies according to the outside temperature and humidity. The time of calcining also varies for the same reasons, and may last from six to twenty-four hours. When the bones are calcined they are withdrawn from the kilns, or retorts, cooled and graded. The hardest bones are held, and used as we shall see later for Drop and Ivory Drop Blacks, the balance are crushed and screened to various meshes to suit the requirements of the Sugar, Oil and Glucose Refiners. The meshes used, vary all the way from 4 x 6 to 90 x dust.

The Sugar Refiners are the most extensive users of the bone, and they use 16 x 30 mesh. They are able to use a Bone Black thirty times before discarding. After each operation the bone is revivified by either heat or steam, and after the thirtieth operation, is unfit for their use. The Oil Refiners use 30 x 50 mesh, and the number of times they are able to use it depends on the nature of their product. Finally, they extract the last available drop of oil, and discard the bone. The Glucose Refiners use 4 x 8 mesh.

After using the bone in the above industries it is often sold to the Fertilizer and Baking Powder Manufacturers, who use it for the phosphate it contains. It is also used as a pigment, and is known in the paint trade as "Spent Bone," and when ground is called bone black.

This bone black is usually lacking in intensity of color and strength, and is the lowest priced Black of this nature.

The hard bones, such as the skull, rib, knuckle, etc., which are held over for pigment purposes after calcining, are known as Virgin Drop Blacks. They are themselves graded, and the different bones are used for different purposes, for example: The shin bone has a distinctly different color and strength than the knuckle bone. The most useful bones are those from the rib, and are prepared and known as Ivory Drop Blacks. These bones give more of a blue undertone, which very nearly approaches the genuine ivory blacks, which are made by calcining ivory cuttings.

Apart from the rib bone, and certain other of the hard bones, the blacks which they yield are known as drop blacks, and while only slightly inferior to the ivory drop blacks, they are considerably blacker than the ordinary bone blacks.

The chief cost of manufacture is the grinding of the blacks. In most instances they have to be ground dry seven times in stone mills before they are fine enough for use, and while there are no set rules as to the number of times they must be ground, they must be ground as often as necessary to keep them within the established standards. It is a very difficult matter to keep these blacks uniform, and great care must be taken in testing each batch for fineness, color, and strength.

Bone, ivory, and ivory drop blacks are used principally on account of their color, which is blacker than lamp or ordinary carbon black. Unfortunately, however, it is very poor in strength of color as compared with other blacks. The ratio being one-fifth the strength of lamp black and one-tenth the strength of carbon black. Even when finely ground, they have a tendency to settle, but it is believed that this can be overcome to a great extent by grinding through a printing ink roller mill, instead of the usual paint mill. The carbon content is about 17%.

c. BONE BLACK: The largest users of bone black have already been given, i.e., Sugar, Oil, and Glucose Refiners. Paint makers use it principally on account of its intensity of color, in which it is superior to lamp black, and the common grades of carbon black. In mixed paints it is still used to a small extent for tinting, although carbon black would serve the purposes better. In varnishes the higher grade bone blacks, such as drop, and ivory drop blacks, were almost exclusively used until the development of the very intense grades of carbon black, which are in some cases used alone, and in others, in conjunction with the drop blacks. The value of drop black is considerably diminished by the fact, that in spite of many attempts at improvement in processes, these blacks continue to settle out of solution and form either a hard mass at the bottom of the container or even when soft, when settled cannot be stirred into solution again by the ordinary methods.

d. CHARCOAL (Willow, Maple and Bass): These charcoals are made in the ordinary way by calcining the thoroughly cleaned wood and then grinding dry in stone mills. The value of these blacks lies in their protective properties for both metal and wood and this is due principally to their slight alkalinity. Willow charcoal is coming into extensive use in making protective paints in the States. The principal drawback is their lack of strength which is usually compensated for by adding carbon black.

e. VINE AND FRANKFORT BLACKS: Originally these blacks were imported from Germany and manufactured by calcining the twigs and limbs of the grape vine, which can be ground much finer after being calcined than any other wood. It is a vegetable carbon, and is used principally as a coloring for food stuffs. It is very rarely used by the paint manufacturers, as it has little strength or color.

f. GRAPHITE: This is another almost pure form of carbon, and is found in nature, either free or mixed with rock or other gangue material. The ore is crushed and the graphite is separated by ordinary milling methods. Grinding the graphite is very difficult owing to its great smoothness and semi-crystaline flaky structure.

Graphite mixed alone with boiled oil has a very great covering power, so much so that it will form a coat so thin as to be of no practical value. It should, therefore, be reduced with a heavy base. Many of the grades are not suitable for re-painting, owing to the very smooth surface it forms. Special grades are made which have a distinct tooth and can be painted over without danger of chipping or curling. It is used almost extensively in protective paints in structural iron work, also in aluminum and bronze paints. Carbon black is usually added to give it the jet black color which it lacks, and Silica, Barytes or other extenders are mixed with it to insure a sufficiently thick coat. It is used to a slight extent in tinting to obtain certain particular shades.

g. BLACK TONERS: These are almost chemically pure carbons and are made by digesting selected bones with Hydrochloric acid. This dissolves everything except the carbon which is left in a flocculent state, and is filtered off from the solution. Preparations of this sort are very expansive, and are sometimes used in conjunction with carbon black or organic dyes. They are very poor driers and are almost out of use at the present time.

h. ASPHALTUM (Gilsonite): A small quantity is used by the varnish manufacturers. It is especially selected for this purpose, from several different grades, which are used almost exclusively in black japans.

i. MINERAL BLACK: It is made by grinding a black slate, and is usually used in conjunction with carbon black, owing to the former's lack of color. When ground in iron paint mills it will dull the sharpest mill in a few hours. It is usually considered better to use a mixture of carbon black and silica, as a cheap black filler.

j. BLACK OXIDE OF IRON: We are going to refer here specifically to magnetic oxide of iron, and in describing the method of its manufacture it will be advisable to mention the other iron oxides, which are made by the same processes, all of which are known under the trade name of "Mapico Pigment Colors." They are prepared by the precipitation process.

To a solution of iron chloride or iron sulphate is added a solution of sodium hydroxide, or specially prepared pure lime. The action of the alkali on the salt causes the iron to precipitate out as the insoluble iron hydrate, which is of a yellow color and in the dilute solution is extremely fine. By heating a solution containing this material and forcing in steam, hot air, or other gases, the yellow iron hydrate looses its chemically combined water, and changes its color to yellows, reds, and browns, in an almost unlimited number of shades, until finally the magnetic iron oxide or mapico black is formed.

The above colors are pure oxides of iron and with the exception of the mapico yellow, contain no chemically combined water. This does not affect the value of the yellow in the least, as the water can only be driven off at a high heat.

The method we have outlined, by which artificial iron oxide is made, has presented to the paint manufacturers a most valuable series of iron colors, all of which are free from acid, pure, strong, and uniform.

The magnetic oxide of iron (mapico black) is represented by the chemical formula Fe_3O_4, and is the only magnetic oxide of iron which has been tested by the American Society for testing materials.

USES: Gardener, who is one of the foremost experts on protective paints in the United States, says in his report, "Magnetic oxide of iron forms an excellent black protective paint when ground in linseed oil." Tests on the mapico black, then known as magnetol, were made at Atlantic City covering a period of five or six years, and show that it is superior to red lead in many respects as a protective paint for structural iron or steel.

In many cases in the past, users of black pigments have regarded most blacks as being interchangeable, their use depending upon price only. You will see from number of varieties and uses we have mentioned that each grade or kind of black has specific uses for which it cannot be efficiently substituted. If as much care were taken in choosing blacks as is exercised in selecting red or whites, for example, better decorative effects and more durable paints and varnishes could be obtained with blacks than is common at the present time.

DR. BANCROFT RETURNS TO McGILL

J. A. Bancroft has resigned the position of assistant manager for the Granby Consolidated Mining, Smelting & Power Company, and will return to the Chair of Geology at McGill University. While occupying the Chair of Geology at McGill, Dr. Bancroft spent several summer vacations at Anyox, studying the geology of the Hidden Creek ore deposits, and this work was so much appreciated by the Granby company that, on the retirement of E. E. Campbell, Dr. Bancroft was offered the position of assistant manager. The directors of McGill were loath to lose Dr. Bancroft, but at the same time, were quite unable to compete financially with the Granby company for his services; they adopted a middle course, however, and gave him twelve months leave of absence, in which to thoroughly test his new position, before accepting his resignation. The wisdom of this course has been justified, as Dr. Bancroft has decided to return to pure science, despite the more alluring attractions financially of applied science.

British Columbia mining men will be sorry to lose Dr. Bancroft, as he has done much for the profession. He inaugurated a class for prospectors at Anyox, and was exceedingly popular among the employees, while his services to the company were mentioned in the last annual report.

L. R. Clapp, who has had considerable copper mining experience in the United States, has succeeded Dr. Bancroft as assistant manager for the Granby company.

EXPANSION OF ANGLO-PERSIAN OIL REFINERIES

The recent completion of the National Oil Refineries, Ltd., near Swansea, marks a new step in advance. The construction cost some fifteen millions, and the plant covers 650 acres. A 10,000 ton tanker is unloaded in twelve hours, and loading capacity is 500 tons an hour. Oil can pass through the refinery in three days from the crude oil tanker to the gasoline user. There are 33 tanks on the tank farm, some 25 having a capacity of 10,000 tons each. The daily throughput is 3,000 tons. Wax and lubrication production will be undertaken on a very large scale. This particular company has a much larger refinery in the Persian Gulf, and is constructing others in Scotland, France and Australia. This is one of the industries which assists the British taxpayer directly, as the Government owns two-thirds of the stock, and the business has been most profitable.

REDMANOL CHEMICAL PRODUCTS CO., CHICAGO

This company has issued a new booklet, illustrating the great variety of industrial articles manufactured from Redmanol. Considerable information is given relating to physical properties and methods used in manufacturing. The booklet is valuable for chemists as it illustrates the large field of usefulness for these products.

Chemical Society News

ANNUAL MEETING, SOCIETY OF CHEMICAL INDUSTRY

Glasgow, July 4th to 8th

The Glasgow meeting, opening this year on July 4th, was of particular interest to Canadians, as Dr. R. F. Ruttan gave the presidential address. The local interest was situated in the chemical industries of the west of Scotland, and numerous industrial and sight-seeing trips were arranged. The annual meeting itself consisted of a morning session, opened by the Lord Provost (Mr. Thomas Plaxton), who described the general suitability of Glasgow for a meeting of those interested in chemical industries. Dr. Ruttan then presented his address, which dealt with the development of Research within the Empire and in America. He pointed out the present trend in the development of scientific and industrial research, the significance of the international organization of science, and post war developments in Overseas Dominions, drawing from these some conclusions regarding the relation of the state to the wider problem. He reviewed the development of the International Research Council, established in Brussels in 1919.

In Australia an Advisory Council of Science and Industry had been formed, which had attempted to increase the number of trained workers. For a time an effort was made to use university laboratories for industrial research work, but more recently a plan for a central, state-controlled Research Institute has been developed. In India, New Zealand and South Africa, under various names, the same general plans were being followed. In India the effort under the Indian Civil Service would naturally be more bureaucratic, and it had been hampered by immediate civil conditions and the lack of interest in such affairs on the part of Indian people who had the necessary wealth to consider business developments.

Dr. Ruttan described in detail the development of Research Work under the Canadian Research Council. He stated that this year, some fifty university graduates were being assisted. The general attitude of the large firms in America, such as Du Pont's, the General Electric and the Eastman Kodak Co., in the question of putting research on a business basis, was considered. The work these firms were doing in pure research in order that it might in turn bear upon their manufacturing operations was most significant. The place of the University should be chiefly the training-ground for the research worker.

In Great Britain Dr. Ruttan saw a most important future for the National Physical Laboratory.

E. F. Armstrong, the new President, proposed a vote of

usual post-graduate studies in Germany. He also worked at Copenhagen with Prof. E. G. Hansen. Leaving purely academic work, he entered an industrial firm as chemist and worked up to the position of managing director of Joseph Crossfield and Sons, Ltd., and William Gossage & Sons. He himself, combines science, technology and business to a very high degree, and his influence during the year will no doubt be specially directed toward the development of a broader outlook along these lines. As an organizer, he should rank as one of the best presidents the Society has had for some time. English chemists and chemical industries need leaders at the moment who can secure a high measure of public attention and bring about more productive business and professional organizations.

Activities of Chemical Engineering Section

This active wing of the Society held some interesting sessions and discussions. "Methods for measuring capacities of storage tanks and kettles" was introduced by J. W. McDavid. He introduced a new instrument which consists of a calibrated system of nozzles, leaving a small reservoir. To operate it, the tank is filled to a definite, but small, overflow. This lead is maintained, and one of the nozzles opened. Then, by a stop watch, the time taken to fill the vessel is known, and its volume is given, because the volume of water passing through the calibrated delivery machine is known.

The general question of evaporation was discussed by Prof. J. W. Hinchley. He presented considerable data on evaporation below boiling temperature and on the increase in rate on convex surfaces.

Mr. Parrish, of the Provan Chemical Works, Glasgow, discussed ammoniacal liquor stills, distinguishing three types of continuous columnar still, according to the arrangement of the free still, the living chamber and the fixed still. The details given on the construction and operation of stills are most complete. Mr. W. A. Walmsley, of the same works, gave a paper on tar distillation. The history of Glycerine Distillation from 1779 to the present time made a most interesting contribution from Mr. C. H. Gray, completing the program of this Section.

The Chemical Engineers in this Section are, for the most part, well known to each other personally, and their meetings are noted for action and lively constructive discussion.

CANADIAN PACIFIC SECTION, SOCIETY OF CHEMICAL INDUSTRY

On Tuesday evening, May 9th, a joint meeting of the Canadian Pacific Section of the Society of Chemical Industry and the Vancouver Branch of the Engineering Institute of Canada was held in the Board of Trade Bldg., Vancouver, for the purpose of hearing an address by John Keillor, gas engineer of the Vancouver Gas Company on the "History and Development of the Gas Industry." A large number of lantern slides were [illegible] the first being conducted by James Murdoch in an old teapot. He made many references to the popular disapproval of the invention, a good illustration of which may be joined in the following lines which were current in Glasgow during that period:

> "We thankful are that sun and moon,
> Were placed so very high,
> That no tempestuous hand might reach,
> To tear them from the sky.
> Were it not so, we soon should find
> That some reforming ass,
> Would straight propose to snuff them out,
> And light the world with "GAS."

After outlining the history of the industry, Mr. Keillor exhibited numerous slides, illustrating the various steps in the improvement of retorts, purifiers, coking plants, etc. He dealt with the problems involved in the saving of by-products, which were formerly lost, and illustrated the newest departure in England, where it is now legal to completely gasify coal, leaving practically no coke or other by-products.—J. A. Dawson, Sec'y.

PERSONAL

A. Grant Lochhead, B.A., M.Sc., Ph.D., (McGill) until recently Chief Chemist of the Malt Products Company of Canada, Limited, Guelph, Ont., has been appointed Lecturer in Biochemistry in the University of Alberta.

After graduating from McGill with honors in Chemistry and taking a year of graduate work in Chemistry and Bacteriology in Macdonald College, Mr. Lochhead studied in Leipzig, where he had practically completed the requirements for the doctorate when the war broke out. He was held as a civilian prisoner in Germany throughout the war, and served in the Ruhleben Prison University as "Professor" of Bacteriology and Italian. After returning to Canada he was appointed Lecturer in Bacteriology in Macdonald College, but resigned after a few months' service to accept a position with the Canadian Milk Products, Limited, Toronto.

Dr. Lochhead is a son of Professor William Lochhead of Macdonald College.

Dr. B. H. Vickery, F.C.I.C., formerly of Halifax, N.S., and a graduate of Dalhousie University, has recently secured the degree of Ph.D., at Yale University. He has been specializing in the chemistry of Proteins. He was formerly in the employ of the Imperial Oil Co., and was active in chemical organization work, being secretary of the Maritime Chemists' Association. His present address is 2 Lincoln St., New Haven, Conn.

W. A. Campbell, a recent graduate of the University of Toronto, Faculty of Applied Science, has taken a position as chemist with the Electroplax Co., Mount Dennis, Toronto.

Mr. James Murray Luck, B.A. in honor science of the University of Toronto, is one of the three Canadians to be appointed to post-graduate science and research scholarships of the Exhibition of 1851, at London University, England. Mr. Luck is a Brantford, Ont. boy, a graduate of Victoria College, and was elected president of the Students' Council at Varsity, at the spring elections, 1922.

MEETINGS OF AMERICAN CHEMISTS

The American Chemical Society holds its fall meeting in Pittsburgh, during the week of September 4th. The American Electrochemical Society will meet in Montreal on September 21st, 22nd and 23rd. Canadians are likely to attend both meetings in more than usual numbers. While the electrochemists are in Canada they will visit the chemical plants at Shawinigan.

The American Ceramic Society will hold a summer excursion meeting to Rochester, Montreal, Ottawa, Kingston, Toronto, Hamilton, Niagara Falls and Buffalo, August 13th to 19th.

NEW BOOKS

"PRINCIPLES AND PRACTICE OF FUR DRESSING AND FUR DYEING"

D. Van Nostrand Co., New York. 190 Pages

This is a work which will appeal to anyone who knows anything about the subject, or has any business interest in it, either directly or indirectly. It is not the first book on the subject, but it is the only recent book of value in English. The whole question of dyeing furs has been wrapped up in a sort of mystery, since the 14th century, and a little daylight, applied science and chemistry would help practice in many places. The book aims to be a text and guide to the practical man, and also gives the operator with some knowledge of chemistry a general idea of the nature of the materials he is dealing with.

The book is just what the name implies, "a practical statement of methods of dressing those furs found on the market, and the best methods of dyeing them."

Doubtless many so-called secrets will be found exposed, but we believe that the fur business is like any other, and will be benefitted by the light of science and advanced training for workmen.

The book is recommended for the place it fills in the literature on applying dyestuffs.

"DYES, CLASSIFIED BY INTERMEDIATES"

By R. Norris Shreve, Warren N. Watson and A. R. Willis, 631 pp. Chemical Catalog Co., Inc., New York. Price $10.

A rearrangement of data from a great variety of sources has been used in presenting a logical classification of dyestuffs. Taking the obvious viewpoint that intermediates are the basic materials from which dyestuffs are made, the complexity of almost numberless dyes is partly overcome, by tracing them back through their process of manufacture.

The book begins with a list of intermediates in alphabetical order, showing the structure of the intermediate, references to original literature, and detailing the dyes made by its use. This information about the dyestuff shows, where possible, the Schultz number, the ordinary name, the class of dye, statistics about imports and manufacture in the United States, general application, and other intermediates used in manufacturing it. The formation of the intermediate is sometimes given in considerable detail. The rules adopted for nomenclature by chemical abstracts are followed. In this way, some 487 intermediates are tabulated and supplemented by a formula index, which offers a quick way of locating a given compound. The latter part of the work consists of a glossary of dye names, as used by various companies. Thus the ordinary names of commerce are connected up with a serial number, where information regarding composition and manufacture may be secured.

This book recognizes that there are many dyers and business people handling dyestuffs, not to mention many chemists employed by dyestuff manufacturers, who need a handy reference of this kind. Marketing and science is getting closer together in works of this type. Without question, both the research chemist and the salesman will find value in this, the first major book on this subject developed in America. The publishers and authors may well be congratulated on the result of what must have been a very considerable labor.

BRITISH EMPIRE STEEL AND FOREIGN TRADE

Reports from Sydney, N.S., indicate that the steel plant is working double time. This will give some 2,300 men employment. The company has made some export arrangements recently, allowing them to take large orders for finished steel products. Most of this business is from the British possessions and southern America.

Investigations by the Mines Branch, Department of Mines, Ottawa

Work Under Way on Canadian Resources

DURING the current year, the Mines Branch will undertake field investigations of mineral resources and their technology through nine parties. The investigation of our mineral resources and of the technology of their mining, treatment, and use provides, primarily, a national inventory of our mineral wealth. The great value and importance of such an inventory was amply demonstrated when these resources had to be called upon for their maximum contribution to the national defence. In the immediate utilization of these resources the investigations conducted furnish the interested consumer, investor, or prospector with a record of the localities where the occurrence of the economic mineral resources has already been determined, and with the available data as to the extent both of their occurrence and of their exploitation. To the owner, discoverer or expectant operator is furnished the collected and accumulated data respecting the physical and chemical characteristics of mineral products; descriptions of methods of mining and treatment commonly employed; the specifications as to the composition and character of the products required to meet market conditions; the uses to which the products are put; the industries in which they are employed, and the essential commercial data respecting markets, prices, production, consumption, etc.

A. W. G. WILSON will complete a report now under way on the development of chemical and metallurgical industries in Canada, and will spend a portion of the field season in the collection of additional information on the above industries for departmental records, and in the investigation of the technology of molybdenum and the mining industry in respect to certain metals.

A. H. A. ROBINSON has been investigating iron ore resources in Canada during the past eleven years, chiefly in magnetometric surveying, and will continue to study the present operating conditions in the iron mining industry.

V. L. EARDLEY-WILMOT is engaged in the completion of the mining sections of a report on molybdenum, and its uses, and will make field investigations in respect to the present condition and progress being made in non-metallic industries.

HOWELLS FRECHETTE will continue and complete an investigation of mineral pigments in eastern Canada, and, as Acting Chief of the Division of Ceramics and Road Materials, will, if time permits, make some field studies in respect to present conditions in the clay-working industries.

HUGH S. SPENCE is investigating conditions in respect to the requirements of the British market for a number of non-metallic products such as mica, graphite, feldspar, etc., and the progress being made in experimental work with a view to determining possible uses of bentonite. If time permits, Mr. Spence will initiate an investigation of abrasive minerals in Canada with particular reference to corundum, garnet, diatomaceous earth, etc., as well as the production of artificial abrasives including the silicon carbide products and the aluminous abrasives.

L. H. COLE ASSISTED BY FRANK McNIVEN will continue the investigations begun last year of the saline lakes and springs of western Canada, with a view to determining their distribution and extent, and their economic possibilities. These saline lake deposits consist of mixtures of salts and sodium, magnesium and potassium, in varying proportions.

S. C. ELLS will complete the mapping of the bituminous sand area in the McMurray district, involving the surveying of the Athabaska river valley from township 88 to township 98, and the sinking of a limited number of test pits, in order to supplement the imperfect information afforded by actual outcrops of bituminous sand. It is anticipated that under favorable working conditions the work of this season will permit the completion of the detailed field investigations of the bituminous sands of the McMurray district, upon which work has been in progress for a number of years past.

H. GAUTHIER will continue a road material survey in the Canadian National Rocky Mountains Parks, in connection with the construction of roads undertaken under the auspices of the Parks Branch of the Department of the Interior.

R. H. PICHER will continue road material surveys begun in 1920 in the Province of Nova Scotia.

The two latter investigations will be supplemented by laboratory tests, by standard methods, of numerous samples of materials collected, the purpose being to supply the engineers on public highway construction with valuable information as to the comparative road-making qualities of the available supplies of material in the neighborhood of the highways being constructed.

Laboratory Testing and Research

The laboratories or experiment stations of the Mines Branch are comprehensively equipped for testing and research investigations on ore treatment, on fuels and oils, with particular reference to their physical and chemical character, and their recovery and utilization, on clays or ceramic and refractory materials, on rocks, sands and gravel used for road building purposes, etc. A staff of five engineers and fourteen chemists, with laboratory and mechanical assistants, are engaged upon the investigations noted below.

Ore Dressing and Metallurgical Division

In this division, under the direction of W. B. Timm, Messrs. C. S. Parsons and R. K. Carnochan, with the assistance of a staff of chemists, are carrying on the following investigations on ore treatment:

COPPER ORES: (a) The completion of experimental work on the concentration by flotation of the low grade copper ores of Hidden Creek, Anyox, B.C. (b) A continuation of experimental work begun during 1921 to determine a metallurgical treatment of the ore of the central, or sulphide, zone of the Flin Flon complex ore deposit. (c) An investigation of methods for the concentration of the disseminated ore of the Flin Flon ore body.

COPPER-NICKEL ORES: An investigation begun during 1921 is being continued on the concentration of the lower grade copper-nickel ores of the Sudbury district. This investigation will be extended to cover nickel ores from other localities such as Shebandowan Lake area west of Port Arthur, Ont., and the Maskwa River district, northeast of Winnipeg, Man.

ZINC-LEAD-SILVER ORES: (a) An investigation, which will involve extensive test and research work, is being conducted on the metallurgical treatment of the ores from the Sterling Mine, Cape Breton. (b) Lead carbonate ores from Arrowhead, B.C., carrying gold and silver values, in which the gold is the principal metal to be recovered, are being investigated with a view to determining a process adaptable to the treatment of the ore.

GOLD ORES: In view of the activity in the development of gold properties, it is anticipated that a number of applications will be received for experimental test work on some typical gold ore.

THE MILLING OF ASBESTOS ROCK: During 1921, experimental work was conducted on the use of the conical ball mill for the cracking of asbestos rock and the liberation of the fibre. It is proposed to continue experimental test work on the application of a wet process for the crushing of the rock and recovery of the fibre.

THE CONCENTRATION OF GARNET FROM ITS ROCK: Investigations conducted during 1921 on shipments from three different localities will be supplemented by further experimental test work on shipments from other localities.

THE CONCENTRATION AND SEPARATION OF FLUORITE OF THE MADOC DISTRICT FROM ASSOCIATED

MINERALS: An investigation is being undertaken to develop a process for the separation of fluorite from its associated minerals such as barite, calcite, and silica.

PLATINUM GROUP METALS: Some experimental work already in progress will be continued on the recovery of these metals from placer concentrates. Work will also be undertaken in connection with the investigation of the presence of these metals in certain copper nickel ores.

REMOVAL OF IMPURITIES FROM COALS: It is proposed to initiate an investigation on the washing and flotation of coals for removal of impurities such as slate, pyrites, etc.

THE USE OF FLOTATION REAGENTS MANUFACTURED IN CANADA: This investigation is a continuation of one undertaken on the treatment of Cobalt ores in 1917, as a result of which valuable information was obtained in connection with the treatment of Cobalt ores. The present investigation is being carried on with all Canadian ores which are being treated by flotation, for the recovery of valuable minerals, and will not be confined to hardwood oils alone, as was the previous study, but to other reagents used, or which can be used and manufactured in Canada for this purpose. A considerable amount of data has already been collected, and with the co-operation of the mining companies using flotation, a systematic investigation will be carried out in order to stimulate the use of Canadian-made flotation products in place of imported oils.

AMBER: An investigation is being undertaken on the concentration and separation of amber from western coals. This is being supplemented by an investigation in the chemical laboratories on the physical and chemical characteristics and possible uses of the recovered amber.

Division of Fuels and Fuel Testing

Under the direction of Mr. B. F. Haanel, investigations are being carried on by Mr. E. S. Malloch, Technical Engineer, and Mr. R. E. Gilmore, Chief Engineering Chemist, and a staff of engineering chemists.

LIGNITE COALS: (a) Investigations are now in progress on carbonization. Small scale experiments originally applied to the lignites of the Souris Valley, Saskatchewan, are being applied to the various grades of Alberta lignites. (b) Investigations are designed to be undertaken in respect to the alterations of lignites which are effected by heat and other treatments, with particular reference to (1) the character of the carbonized residue, yield of gas, tar oils and ammonia; (2) thermal reactions covering a wide temperature range to determine exothermic and endothermic points; (3) physical and chemical examination of residue with regard to briquetting qualities; (4) the effect of varying pressure and atmosphere in retort on the quality of the residue; (5) the determination of physico-chemical properties of raw lignites and their products.

OIL SHALES: An investigation is in progress respecting the destructive dis[illegible] oil shales, with particular reference [illegible] digested in a

DOMESTIC HEATERS: Investigations are in progress with a view to determining factors and suggesting alterations in design of heaters to permit the more efficient utilization of fuels other than anthracite.

Division of Ceramics and Road Materials

Laboratory tests on clays and shales are being conducted to such an extent as is possible with the available staff. The examination and testing of road materials is carried on chiefly during the winter months by the engineers who, during the field season, are engaged in the study of field conditions and in the collection of the samples. In connection with the latter work it is also proposed to carry on investigations of methods of testing. The Road Materials Division is allied with organizations of a similar character which co-operate, through the medium of the American Society for Testing Materials, to the end of advancing knowledge in the testing of road materials.

World Conditions and News in Chemical Fields

(Special Correspondence to Canadian Chemistry and Metallurgy by our London Representative.)

The association of British Chemical Manufacturers now list 1,700 fine chemicals, formerly made in Germany.

An English Company are manufacturing hollow cored bars, by first drilling the bar and packing it with a composition which, when rolled, will stretch, leaving the finished bar with a small opening. These bars are used for mining drills, and allow air or water to be placed right in the cutting edge, avoiding excess dust.

The British Non-Ferrous Metals Research Association have been carrying out an extensive research on the influence of gases on high grade brass. New work is under way on a study of conditions necessary for securing both surface and internal soundness on strip brass ingots, such as are required for cold rolled sheet metal. Dr. Harold Moore and Mr. B. Genders are in charge of the work at the Woolwich laboratories.

The Belgian Glass Industry

This includes glass of all descriptions. Both skilled help and equipment were lost in the war, but recovery has been very rapid. Before the war, 50,000 tons of carbonate of soda per annum were consumed, about one-half of which was supplied by the Solvay Co. 100,000 tons of sodium sulphate were consumed. The sand came principally from France. In 1913, exports of window glass totalled 206,000 tons; in 1920, it amounted to 176,000 tons, and in 1921 to 109,515 tons. Plate glass, in 1913, amounted to two and one-half million square meters. In 1920, this was exceeded, being 39,570 tons, and 23,534 tons in 1921. Over 31,000 tons of table and crystal glass were exported from Liege in 1913. This business was originally introduced from Italy. One factory employed 5,300 workmen, with 15 furnaces, and produced an average of 250,000 pieces of glass per day. Some 90 per cent. of the business was export. This [illegible] had remarkable return to prosperity, but during [illegible] ported. Bottle manufacture [illegible] 14,400 tons, and [illegible] with

	Works	Production (Metric tons K_2O per annum)
Saxony	46	411,300
Thuringia	15	189,780
Anhalt	8	95,486
Brunswick	5	

In all, about 32,000 workmen are employed. The control of German potash is as follows, giving percentages of stock held by combining companies:

Deutsche Kali and Wintershall	39.6%
Aschuslehen-Westerregal	17.6%
Burbach-Volken-roda	8.6%
Gumpel-Heldburg	6.8%
Prussian Fiscal Works	5.9%

Switzerland

Over 150 English Dyers visited the Chemical Works at Basle, on June 6th and 7th. The three principal color makers, the Society of Chemical Industry, Messrs. J. R. Geigy, and the Sandoz Chemical Works, united in their entertainment. These companies have a capitalization of 35,000 million francs. During the war they rendered a great service to England and the allies in supplying dyestuffs and intermediates.

The aluminum industry is well developed through the Aluminum Industry Society of Neuhausen. Markets have been found in Japan, the United States, and British India, for vessels, bars, plates, tube and wire.

Czechoslovakia

Industry and science is advancing at a remarkable rate in this country. Reports of returning visitors indicate that there is the closest co-operation between the research workers and plant practice, and an appreciation of efficiency that exceeds in practice anything generally attained on this side.

The most intensive work has been going forward here, and in Germany on the problem of liquid fuels. An interesting process has been developed by Blumner for continuous distillation and cracking of oils from lignite and shale. It is claimed that the precipitation of coke has been avoided and a smooth heat transmission secured by a uniform distribution of the injected raw material and the prevention of temperature alteration, by using molten lead as a heating medium. This heat accumulator metal having been melted in the still and adjusted to about 430° C., pre-heated raw oil, at 1,000 kgs. per hour, is injected. This is for a still of capacity of 1,000 litres. The pressure in the still rises until the working pressure of a self-acting outlet valve is reached (about 600 lbs. to square inch). The slightest pressure above this conveys the cracked products into a small separator filled with Roschig rings, and kept at a given temperature, along with the high boiling point fractions and the asphalt, and from whence they are drawn for continuous operations. The same condensing plant will operate a number of the 1,000 litre stills.

British Chemical Trade Improving

England has been having a fairly rapid return to better times lately. The breaks have not all been against her. German iron and steel competition is not so serious, and, above all, her coal exports have shown much life and expansion.

Chemical and drug imports to June 30th, 1922, reached over £5,354,000, as compared with £7,498,000 for 1921, and £6,980,000 for 1920.

Exports for the same period amounted to over £10,913,000 for 1922, £11,035,000 for 1921, and £18,972,213 for 1920.

British made aniline dyes went down from £1,069,502 for 1921 (6 months), to £319,717 for 1922.

It is stated that German firms are now seeking to secure co-operation with English dyestuff manufacturers. German interests fear that the continued Government support of the dyestuff industry may make their progress impossible, and they now propose certain price arrangements and offer the British industry information on manufacture. It is obvious that Germany knows that she is as likely to lose as gain by being out of touch with British technical developments.

New Uses for Rubber

The results of 2,000 entries, suggesting new uses for rubber, come down to a few practical proposals, according to the Rubber Growers' Association. These are: sponge rubber for upholstery; rubber in liquid form for paint and wood preservation, also against salt water; incorporating it with cement for building purposes; a heat-retaining covering.

A recent American report suggests using rubber in road building, and a fairly new use is its addition to paper.

Lead Hydrate Storage Batteries

These are being produced in England with many claimed superiorities, chiefly of the fool-proof variety. They cannot be damaged easily and have a larger capacity. They are free from local action, because of the purity of the material and can be left for years in any state of charge or discharge. The plates are very thick, and the acid electrolyte much stronger. Plates are put in stock fully formed and discharge directly they are put in the acid at 2.1 volts per cell.

French Chemical Prices

The general demand is improving. The liquid carbonic acid business is disturbed by the practice of using compressed air in some beer factories. Wood distillation products are in better demand, and alcohol production is increasing slightly.

A CONFERENCE ON ONTARIO IRON ORES

The Minister of Mines, the Hon. Harry Mills, was mainly responsible for an important gathering in Toronto on July 5th. Representatives were on hand from every interest, from owners to Dominion geologists. This symposium covered:—

1. The extent of the iron ore deposits.
2. The kind and quality of the deposits—Eastern Ontario ores, banded magentic or mixed magnetite, or hematite, siliceous hematite, siderite and bog iron ores.
3. The economic possibility of magnetic concentration methods. Processes for increasing the metallic content of siliceous hematites.
4. What is the Ontario market for beneficiated Ontario ores?
5. Is present pig iron production at the limit of the market?
6. Can the problem be attacked by adopting a method of reduction to low grade ores rather than by treating these ores so as to make them suitable to present blast furnace practice.

Years ago, it was the custom to point out the similarity of Ontario ranges to those of the United States. It was the differences, however, according to Mr. C. W. Knight, Provincial Geologist, that accounted for the lack of suitable ore bodies. Dr. W. H. Collins, of the Dominion Department, gave a most complete account of the various ranges from close personal study.

Others who spoke were: Mr. T. B. Caldwell, on the Iron Range at Temagami; Mr. Dreany, of Sault Ste. Marie, on the Michipicoten District; and Mr. H. C. Cox, of Port Arthur, on the Moose Mountain Iron Ore.

The important deposits of the Belcher Island were discussed. These are low in phosphorus and sulphur, but rather high in silica.

Processes of beneficiation were summarized by Mr. G. C. MacKenzie, of the Canadian Institute of Mining & Metallurgy. His conclusions were that the magnetic ore deposits of Eastern Ontario are too small and scattered to stand costs of concentration. He also thought that sintering was preferable to nodulizing in the agglomeration of fine magnetic concentrate, and that any process will succeed commercially only if operated on a very large scale.

During the discussion, the Eustic process for direct production of steel from ore was highly recommended. Mention was given to the suggestion of Mr. Bradley-Stoughton, of New York, that electrolytic, rather than electrothermic, reduction of iron, offers possibilities for commercial application in Central Canada.

The fine magnetic concentrate from Ontario ores would be an ideal material for the production of sponge iron. The Bureau of Mines is now working on this.

The most important contribution made to the conference was very probably that from Mr. J. D. Jones, Manager of the Algoma Steel Corporation. This company has been making use of treated ores and Mr. Jones has studied plants in the Central and Eastern States quite recently. Lake ore cannot now compete on the Atlantic Coast with high grade concentrates, made from local low grade material. Even ore from Brazil and Cuba is almost excluded. Mr. Jones believes that Ontario ore can be used for Ontario furnaces, if the problem is attacked with energy.

The iron ore from all mines of Lake regions is blended to produce standard mixtures. To produce the quantities of all grades for all sorts of iron from Ontario ores would be a large undertaking, but by specializing, a regular market can be had, and a good price secured. Some actual cases were quoted. Magpie Mine Nodules are known to have a preferred market because of their form, and chemical composition. Sintered magnetic concentrate is one of the standard iron ores. Grounded briquettes are not so well known, and the men with furnace experience present were very hopeful indeed in their remarks.

The immediate problem is the practical one of costs, wages, and means of actually securing the result desired. It was suggested that the Government make a special effort to induce production through a commission consisting of a geologist, a blast-furnace operator or metallurgist, and a representative of transportation interests.

Through the co-operation of scientific and practical studies and the proper expenditure of private funds in development and marketing, this most important problem can be advanced much nearer a complete solution. The Government of the Province should be congratulated on the very keen and intelligent way the matter is being followed up.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy)

There was a splendid attendance at the Northwest Mining Convention, which was held at Nelson on July 3rd to 7th. The convention, which now has become an annual event, was started in Vancouver four years ago, and originally was intended to be a meeting of the mining men from British Columbia and from the States of Oregon and Washington, but at the Nelson meeting there were several delegates from more remote States. The convention was opened by Lieutenant-Governor Nichol, and addresses were given by the Hon. William Sloan, Minister of Mines, and by T. A. Rickard of San Francisco, the former choosing for his subject "What the Government is Doing for Mining," and the latter "The English-Speaking Peoples." Both addresses were much appreciated. A large number of interesting papers were read by the various delegates, the staff at the Trail smelter contributing liberally in this respect. A trip was made to the Trail smelter, where the delegates were entertained at lunch in the new copper-rod mill by the Consolidated Mining & Smelting Company, General Manager Blaylock and his staff acting as waiters.

What may turn out to be the most important event of the convention was the announcement by S. G. Blaylock that a soft pliable iron had been made in the Consolidated Company's laboratories from the tailing of the Sullivan mine ore. Sullivan mine ore is composed of zinc blende, and marmatite, galena, pyrrhotite, pyrite, and from three to six per cent. of gangue. The predominating mineral is pyrrhotite, which forms fully fifty per cent. of the ore, giving it an iron content in excess of thirty per cent. In dressing the ore some of the galena is first removed by tables, and the tailing from these is ground finely and the zinc and lead minerals are separated from the iron sulphides by selective flotation. In the past the iron sulphides have flowed away as waste, and if in the future these can be saved and utilized, the metallurgists at Trail will have added another success to their already long list of successes. When the first unit of the new concentrator, now under construction at Kimberley, is completed, it will treat 1,500 tons of Sullivan ore daily, and if the iron content can be saved as well as the lead and zinc contents, it will mean the production of between 400 and 450 tons of iron daily. This would be important to British Columbia, where at present, there is no iron and steel industry, and where all the iron and steel used has to be brought from eastern Canada or imported from foreign countries, freight rates adding immensely to the cost of the material. Of course, at the present time, the research is only in the laboratory stage, but, as a rule, the Trail officials do not talk a great deal about what is being done in the laboratory unless there is reasonable hope that the invention will be commercialized.

The recovery of iron from pyrrhotite is not new. The problem has long held the attention of the Sudbury metallurgists, with a view to producing nickel steel directly from Sudbury ore, and thus avoiding an annual waste of from three to four hundred thousands of tons of iron in the slags. In 1907, the late E. A. Sjostedt, produced 168 tons of nickel-copper pig-iron from Sudbury ore in an electric furnace at Sault Ste. Marie, but at that time metallurgists had such a deeply rooted objection to the presence of even small quantities of copper in structural steel, that no one could be induced to take up the invention. Several experiments have been tried since then with a view to producing nickel-steel directly from Sudbury ore, but, so far as the writer of these notes is aware, no commercial success has been achieved. If, therefore, the laboratory experiments now being conducted at Trail should result in the perfecting of a commercial process for the production of iron from pyrrhotite, the Sudbury region is likely to benefit equally with the Kootenay region.

Successful Results of Premier

The Premier Gold Mining Company distributed a dividend of fifteen per cent. for the quarter ended June 30th. This brought the disbursement for the year to $1,250,000, and the total disbursement since the first dividend was paid in December of last year to $1,650,000. The capital of the company is only $5,000,000, and already, within six months of the payment of the first dividend, thirty-three per cent. of the capital has been returned to the fortunate stockholders in dividends. The stock is held by only a few people and corporations. Trites & Wood, of Fernie, and W. R. Wilson, president of the Crow's Nest Coal Company, are the Canadian stockholders; American Smelting & Refining Company, Guggenheim Brothers, Minor Keith, Isaac Untermeyer, and R. K. Neill are the United States stockholders. The property is now fully equipped; the transportation difficulty, which for a time greatly retarded production, has been solved; and an ore-reserve capable of maintaining the present rate of production for several years has been developed. Every indication, therefore, points to the continued success of this wonderful mine.

Half a mile south of the Premier mine, and situated partly on British Columbian and partly on Alaskan territory is the Daly-Alaska mine, which is being developed by Pat Daly and New York associates, who have uncovered some promising ore-bodies, which are said to be very similar in character to those found on the Premier property.

Notes

C. A. Banks, consulting engineer for the British Columbia Silver Mines, Ltd., has a gang of men on development and exploration work to the immediate north of the Premier mine. Two-thirds of the stock of this company is held by a subsidiary company of the Seluqua Gold Mining Company, of South Africa, and the other third is held by the Premier Gold Mining Company.

The Fish Creek Mining Company is developing a property on the Alaskan side of the international boundary, and is finding some good ore. Several shipments were made from this property last year, and a good deal more ore will be shipped as soon as the Alaskan Government completes the road it is building to the property.

The Silverado group, situated high up on a mountain on the opposite side of the Bear River to the town of Stewart, has been closed. The property is in good condition, a 16-inch vein of high-grade ore has been developed, and several shipments of ore running from $400 to $600 per ton have been made. A good deal of inconvenience was occasioned by snow-slides in the spring, and, owing to the peculiar situation of the mine, the transportation of ore has been difficult. No information is available as to when the mine will be re-opened.

George Wingfield, of Reno, Nevada, has obtained a Court order for an accounting prior to an order for foreclosure of the Dolly Varden and Wolf mines, the Dolly Varden railway and rolling stock, and all equipment at the mines and at the wharf at Alice Arm, on all of which he holds a mortgage. It is to be hoped, therefore, that soon some arrangement will be made for operating this property, which now has been idle for more than a year. In the meantime, the Provincial Government is repairing the railway, which is eighteen miles long, so that prospectors and miners owning claims along the line and at the head of Kitsault valley may be able to take supplies to their properties on hand cars.

Two new discoveries have been made in the upper workings of the Esperanza mine, situated two and a half miles from Alice Arm. Both ore-bodies are of workable size and show ruby silver freely. The mine has been shipping steadily to Anyox since the beginning of last winter.

The Nickel Plate mill has been re-started, after some twenty months of idleness. The Nickel Plate mine, which is situated at Hedley, has been one of the best gold producers in the Province, at one time providing a quarter of the total gold output, as well as large quantities of arsenic.

The Liberator Mining Company, which owns the Emancipation mine, near Hope, has completed its mill and cyanide plant and put it in operation.

Another shipment of bonanza ore has been made from the I. X. L. mine, near Rossland. Within the last year lessees who have been operating this mine, have cleaned up more than $30,000. The shoot is four to six inches wide and about fifteen feet long and exceedingly rich.

The Consolidated Mining & Smelting Company has re-started its Rock Candy fluorspar mine and mill, at Leach Creek. The mine, which produced 7,500 tons of fluorspar concentrate in 1920 was closed early last year, as there was no demand for fluorspar.

The ore receipts at the Trail smelter for the first half of 1922 totalled 222,704 tons, which is a marked advance over the same period of last year. The Consolidated company is doing little but development at its Rossland mines, and it is not expected that it will ship any large quantity of ore until the new concentrator at Kimberley is finished. This will release the 1,000-ton concentrator at Trail, which now is being used to treat Sullivan ore, for Rossland ores, and it has been demonstrated that it is more economical to dress the ore before smelting. A considerable number of independent mine owners are now shipping to Trail each week.

PLANS FOR NEW YORK CHEMICAL EXPOSITION

Arrangements Completed for a Large Exposition and Noted Speakers During the Week of September 11th

The chemical and metallurgical industries of Canada will again be represented at the Eighth National Exposition of Chemical Industries which will be held this year during the week of September 11th to 16th, at the Grand Central Palace, New York. The great raw material supplies of the Dominion, particularly in the matter of metallic ores and wood chemicals and other products of the forests, together with the water power as yet undeveloped and available for use in these industries, will be the subjects for the Canadian exhibits at this year's Exposition. While the Canadian exhibitors will exploit the vast raw materials of the provinces and illustrate the opportunities for American capitalists in Canada, the chemical and chemical equipment industries of the United States will have on display the products which are in turn used by the consuming industries of the Dominion. Chemicals and chemical machinery for the pulp and paper industry, for the mining and metallurgical operations, for the wood distilling plants, and others will be shown in practically every phase.

Among the exhibitors from Canada who have contracted for space at the 1922 Exposition thus far, are included the Department of Mines of the Province of Ontario and the Canadian Department of the Interior with exhibits by the Forestry Service, Water Power Branch, and the Bureau of Statistics. In the Canadian Section of the Exposition, the British-American Nickel Co. will have a booth. The International Nickel Co. will also display the products which they manufacture, from the ore to the finished metals. The scientific press of Canada will be represented by CANADIAN CHEMISTRY AND METALLURGY, "Canadian Mining Journal," "Canadian Textile Journal," "Iron & Steel of Canada," and "The Pulp & Paper Magazine of Canada."

Among those speaking during the week will be Herbert Hoover, Secretary of Commerce, and frequently referred to as "the business man of the Cabinet," has been secured to speak before the annual convention of the Salesman's Association of the Chemical Industry, which will be held at the Grand Central Palace in conjunction with the Exposition. Mr. Hoover will talk on "Standardization, and What It Can Do for the American Chemical Industry." Wayne B. Wheeler, general counsel for the Anti-Saloon League and considered one of the foremost authorities in the United States on alcohol and prohibition legislation, and also active in the rigid enforcement of the Volstead Act, will address the assemblage at the Exposition on "The Attitude of the Anti-Saloon League Toward Industrial Alcohol."

Both speakers, known to draw capacity audiences anywhere in the United States when they speak, will make up only a small part of one of the most ambitious program ever planned before to be held at the Chemical Exposition. With some 50,000 American chemists as well as an equal number of chemical business men expected to be present at the Grand Central Palace during the week of the Exposition, the ready acceptance of invitations to speak at the various meetings by numerous prominent scientists and chemical executives, already bids fair to overcrowd the program. Each afternoon the program will be given over to a series of events to be arranged by one of the scientific or business associations of the chemical industry, according to the plans which have been tentatively outlined. Thus far, the Technical Association of the Pulp and Paper Industry, the Synthetic Organic Chemical Manufacturing Association, the American Ceramic Society, the Salesmen's Association of the American Chemical Industry, and the Technical Photographic Publicity Dept. Chem. Exposition and Microscopical Society have arranged to take care of the program for one afternoon each. The Standardization Program with its numerous different phases will also fill an afternoon session.

The evening sessions will be given over exclusively to motion pictures, a number of which will be in the form of illustrated lectures on various developments in the chemical and allied industries. All meetings will be held in a special auditorium in the Grand Central Palace, provided for the purpose.

The Technical Association of the Pulp and Paper Industry, however, has about completed its program which includes among the speakers the following: W. C. Edge, Paul B. Huyette Co. on "Safety and Efficiency Appliances for the Boiler Plant"; E. J. Trimbey, Trimbey Machine Works, on "Trimbey and Tibbitts Proportioning and Metering System for Paper Stock"; George D. Dickey, Industrial Filtration Corp. on "Rotary Filters for Washing Paper Pulp and Filtering and Washing Caustic Lime Mud" (illustrated); R. G. Walker, Oliver Continuous Filter Co., "Efficiencies and Economies in Washing Black Liquor from Digested Soda and Sulphite Stock"; L. D. Mills, the Merrill Co., on "The Merco Nordstrom Plug Valve"; H. S. Thayer, Atlas Electrical Devices Co., on "Testing Colored Materials for Fastness to Light"; A. E. Campbell, the Schaeffer & Budenberg Mfg. Co., on "Instruments for Promoting Efficiency in the Paper Mill"; C. C. Phelps, Uehling Instrument Co., on "The Carbon Dioxide Record of Combustion Efficiency"; Harry Carlson, Sandvik Steel, Inc., on "Steel Belts and their Application to the Solution of Conveying Problems"; H. Austin, Ernest Scott & Co., on "Scott Evaporators as Used in the Paper Mill for Recovering Soda from Spent Liquors"; F. M. Rockwell, Willson Goggles, Inc., on "Dust Protection with Particular Reference to the Use of Respirators."

On the Standardization Program, tentative arrangements have secured the following speakers: W. D. Collins, United States Geological Survey, on "Moderation in Standardization"; N. F. Harriman, United States Bureau of Standards, on "Standardized Testing Apparatus"; I. G. Jennings, Glass Container Association, on "Discussion of the reasons for the Varieties of Shapes and Sizes"; J. M. Roberts, Secretary of the Apparatus Manufacturers' Association of the United States, on "What Has Been Accomplished in the Standardization of Scientific Apparatus"; Ross C. Purdy, Secretary of the American Ceramic Society and Chairman of the Committee on Refractories of the American Society for Testing Materials, on "Standardization of Fire Clays and Refractories." Other details of the program have not as yet been arranged, and will be announced at a later date.

Exhibits and Exhibitors

Every branch of the chemical and chemical equipment industries will be represented among the exhibitors at the 1922 Exposition of Chemical Industries as well as numerous allied houses. The chemical products which will be on display will include all types manufactured in the United States, coal-tar medicinals and dyestuffs, technical chemicals for the rubber, leather, paper, textile, paint, and other consuming trades—"everything in chemicals from the crudest of crude materials to the most delicate aromatic, ready for the perfumer's use." In the apparatus and machinery branches, the exhibits will take in every phase of chemical plant and laboratory equipment. A number of new devices, developed during the past four years since the termination of war-time activity, and completed since the 1921 Exposition, will be displayed for the first time this year. Many improvements on machinery long standard, for industrial operations will be shown for the first time. A great many of the machines and instruments will be seen in actual operation. Something new in a special high capacity evaporator lead pumps for handling phosphoric acid under pressure, a new adaptation of all the hard rubber pump in muriatic acid loading, a recent development on a balanced automatic control valve, and in a direct reading resistance thermometer, new ideas in pyrometers, developments of the past year in butyl alcohol derivitives for solvent purposes, recent developments in the use of chlorine bleach liquor in the paper industry in place of bleaching powder, new dust controlling and humidifying equipment, new ideas in loading machinery for trucks, new departures in all types of containers, steel, fibre, wood, and glass; new ideas in all branches of the industry will be on display. A novel plan of one of the well-known associations will be the arrangement of a wall chart on which will be listed every manufacturer in the United States of ordinary quicklime with a full chemical and physical description of each brand now on the market.

There will be in the Exposition, some special sections. One section will be given over to photographic materials, supplies and microscopes in conjunction with the exhibit of the Technical Photographic and Microscopical Society. Another section will be given over to exhibits showing fire prevention and dust explosion in mills, industrial plants, grain elevators, mines and factories. There will be shown, fire extinguishing apparatus of the most modern kind. Another section will be the Container Section, showing shipping containers of all kinds, and where packaging, labeling, package handling and shipping machinery will be exhibited.

To date, in the neighborhood of 400 firms have contracted for space at the Exhposition, and basing predictions on recent figures, about 450 are looked for by opening day, on September 11th next. These figures compare with 83 exhibitors at the original exposition in 1915, and 427 in 1921.

Canadian Chemistry and Metallurgy will be found represented at Booth 470, and as usual will be particularly at the service of all visitors from Canada.

CATALOG OF CANADIAN LABORATORY SUPPLIES

Laboratory Apparatus for Educational, Industrial, Medical and Public Health Laboratories

Canadian Laboratory Supplies, Ltd., deserve very considerable credit for putting out the most complete catalog of such equipment ever produced by a Canadian firm.

Some 340 pages, neatly and well bound, contain all the essential requirements of any modern laboratory, whether designed for routine or research work. The material illustrated is ample in all departments, and good judgment is indicated in condensing descriptive matter. In this way, probably one hundred pages are gained over the average catalog of this kind.

Equipment is illustrated and listed in alphabetical order. For example, balances of all kinds and for all purposes, ranging in price from $1 to $400, occupy the first 27 pages. Under the head of "beakers," will be located flasks and similar glass equipment. The plan of the book is to place together, as far as possible, items of a somewhat related nature, at the same time maintaining very strictly to alphabetical order. The section devoted to glassware amounts to 85 pages. Laboratory hardware of all kinds falls naturally together, under this system. A full list of equipment is given for magnification, color comparison, measurement of rotation, refraction, projection and photomicrography.

A very considerable amount of special apparatus is illustrated, such as is used for milk testing, soil analysis, and special equipment for biological work, public health and hospital laboratories. A very complete line of temperature-measuring instruments and electricially controlled recordng devices is shown. Laboratory utensils, both of platinum and non-metallic manufacture, receive full illustration and description, along with heating and oven devices.

The later portion of the book is devoted to the requirements of schools, colleges and universities, in the departments of botany, zoology, medicine and allied subjects. Standard microscopic slides are listed, covering practically all distinctive organisms of vegetable and animal nature. A full list of stains, covering the whole field, with considerable information regarding the use of those of a special nature, completes the work. Prices are quoted for everything listed, f.o.b. Toronto. Every item listed may be located through the general index.

Whatever credit there may be in the production of this catalog, which creates a new record in serving Canadian chemists, should go chiefly to Mr. James H. Wilson, President of this Company, whose experience in this business in Great Britain and Canada has been most complete, and whose work on this occasion is quite up to the best produced elsewhere.

Chemical Oil and Metal Markets

The Quotations Below Represent Manufacturers' and Wholesale Importers' Prices at Toronto, Montreal, or Other Canadian Points.

CHEMICALS

The middle of the summer finds the Canadian chemical market in a sound healthy condition. In summer periods the market usually enters a quiet state with prices easing considerably. The feature of this summer's trading, however, is the remarkable way in which prices are holding firm. Indeed, several lines have advanced, such as carbon bisulphide, carbon tetrachloride, yellow prussiate of soda, tartaric acid. There have been very few declines in quotations. Caustic potash in large drums is somewhat easier, roll sulphur is back to $4.25 to $4.75 per cwt. after an advance that lasted about a month, and zinc sulphate has eased off about ¾c. per lb. But with these three exceptions, there has been practically no lowering of prices in the heavy chemicals.

The consuming industries are keeping up a good demand for chemicals, exceptionally so for summer trade. The textile mills and the rubber industry are the heaviest buyers, but there is a very fair business being done with the tanneries, paper mills and drug houses. Many dealers report the soap factories to be very actively in the market. Steel mills are buying a fair amount, but their business is adversely affected by the coal shortage.

The coal strike is undoubtedly making itself felt on the chemical market. Both Montreal and Toronto firms have had orders of American-made chemicals held up indefinitely, due to the coal shortage. Should the strike not be settled very shortly, a serious situation faces importers of American goods. It was estimated by a reliable statistician at the end of June, that had the coal strike ended immediately, more than 900,000 cars would have to be loaded at the mines monthly for the rest of the year if the normal annual production was to be attained. As "The Industrial Digest" (New York) points out, this number of cars is very close to the maximum capacity possessed by the railroads under favorable conditions, and since the estimate was made not only does the coal strike continue, but the railroad shopmen have gone on strike, thus reducing the number of cars available to the railroads. Congestion is therefore inevitable, and a serious coal famine quite possible, even if the strike ends immediately.

METALS

The copper market is exhibiting a firmness that is surprising, and during July quotations on the electrolytic advanced about 20 cents a cwt. But of all the non-ferrous metals, zinc has proven the most lively and has advanced steadily all summer. On August 1st, zinc in car lots was quoted at $7.65 per cwt. (Toronto and Montreal) an increase of 90 cents per cwt. since July 1st. It is of course expected that the coal strike will affect the zinc market shortly, but up to August 1st the galvanizers had slackened their demand but little. The lead market keeps steady, though no great activity is reported. Quotations, however, have advanced 15 cents a cwt.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.95— 5.15
Ammonium Bromide	Lb.	.. — .38
Aluminium Sulphate, bags	100 Lbs.	.. — 2.50
Aluminium Sulphate, iron free	Cwt.	.. — 4.50
Ammonia, Aqua, 26, Carboys	Lb.	.. — .14
Ammonia, Aqua, 26, Drums	Lb.	.. —.09½
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb	.. — .14
Barium Sulphate (Barytes)	Pre Ton	**30.00**—35.00
Barium Chloride	Lb.	.05— .07
Barium Nitrate	Lb.	.. — [illegible]
Barium Peroxide	Lb	.. — .26
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, **over 1.400, up to** and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	.02½— .03
Borax, crystals	Lb.	.07⅛—.07¼
Boric Acid, powdered	Lb.	.. — .13
Bromine **(technical)**	Lb.	.. — .38
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —95.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	.. —100.00
Calcium Chloride, fused	Per Ton	36.00—38.00
Calcium Chloride, flake	Ton	40.00—42.00
Caustic Soda, ground, drum	Cwt.	6.00— 6.25
Caustic Soda, solid, drum	Cwt.	5.00— 6.00
Camphor **Monobromate**	Lb	.. — 3.00
Carbon **Bisulphide, in drums**	Lb.	.11 .12
Carbon **Tetrachloride, drums**	Lb.	.20 .21
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, imported	Per Ton	20.00—25.00
Cobalt Oxide, black	Lb.	.. — 2.00
Cobalt Oxide, grey	Lb.	.. — 2.25
Copperas (Iron Sulphate) crystals	Lb.	.02—.02¼
Copperas (Iron Sulphate) sugar	Lb.	.02—.02¼
Copper Sulphate (Blue Vitriol)	Lb.	.07—.07½
Corrosive Sublimate (Mercuric Chloride)	Lb.	.. — 1.10
Fluorspar, ground	Tons	.. —30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.11— .12
Ferric Chloride, solution	Lb.	.. — .10
Hydrofluoric Acid, 60%	Lb.	.. — .28
Hydrofluoric Acid, 30%	Lb.	.. — .14
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	.70— .75
Iodine, crude	Lb.	.. — 4.50
Iodine, resublimed	Lb.	.. — 5.25
Iron Oxide (red)	Lb.	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.14 — .15
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.09— .10
Lithium Carbonate	Lb.	.. — 1.70
Lithopone	Lb.	.06— .07
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl	Lb.	.09— .11
Magnesium Sulphate	Lb.	.03— .04
Mag. Sulphate, B.P., Medicinal	Single Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Muriatic Acid, 18	100 Lb.	2.75— 3.00
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt	Lb.	.. —.16½
Nickel Salt, double, barrel lots	Lb	.. — .15
Nickel Salt, double, per cwt	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lb.	.09—.09¼
Phosphoric Acid, 85%	Lb.	.. — .28
Phosphoric Acid, 50%	Lb.	.. — .22
Phosphorus, yellow	Lb.	.. — .34
Potash Prussiate, yellow	Lb.	.28— .30
Potassium Bicarbonate	Lb.	.. — .20
Potassium Bromide, crystals	Lb.	.22— .30
Potassium Bromide, granular	Lb.	.22— .30
Potassium Bichromate	Lb.	.. — .25
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .09
Potassium Chlorate	Lb.	.. — .10
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .80
Potassium Hydroxide (caustic potash) small drums	Lb.	.20— .22
Potassium Hydroxide (caustic potash) large drums	Lb.	.08— .09
Potassium Iodide	Lb	.. — 3.95
Potassium Nitrate, casks	Lb.	.. — .10
Potassium Permanganate, bulk	Lb.	.65— .70
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. — 9.00
Soda Ash, bags	Cwt.	2.25— 2.40
Sodium Acetate, ton lots or over	Lb.	.. —.06½
Sodium Acetate, lesser amounts	Lb.	.. —.07½
Sodium Benzoate	Lb.	.75— .80
Sodium Bicarbonate, 100% pure	Lb.	2.50— 3.00

Sodium Bichromate, bbls	Lb.	.10— .13
Sodium Bisulphite, powder	Lb.	.. — .06
Sodium Bisulphite, 35	Lb.	.05½— .06
Sodium Bromide (foreign)	Lb.	.30— .35
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. — .31
Sodium Hyposulphite, kegs	100 Lb.	5.85— 6.00
Sodium Hyposulphite, barrels	Cwt.	5.25— 5.50
Sodium Iodide	Lb.	.. — 4.60
Sodium Nitrate, refined	Cwt.	6.75— 7.00
Sodium Nitrate, crude, 95%	Cwt.	5.00— 5.75
Sodium Nitrite	Lb	.12— .15
Sodium Peroxide, f.o.b. New York	Lb.	.30— .35
Sodium Silicate, 42°, car lots	Cwt.	.. — 1.40
Sodium Silicate, 42°, smaller lots	Cwt.	.. — 1.60
Sodium Silicate, 40°, car lots	Cwt.	.. — 1.30
Sodium Silicate, 40°, smaller lots	Cwt.	.. — 1.50
Sodium Sulphate (Glauber's Salts) crystals,		
	Per Cwt. in Bags	1.90— 2.00
	Per Cwt. in Car Lots	1.65— 1.70
Sodium Sulphite	Lb.	.. — .05
Sodium Prussiate, Yellow	Lb	.22— .23
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	4.25— 4.75
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars		23.75—24.00
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Ton	.. —23.00
Tin Chloride crystals	Lb.	.30— .35
Tri-sodium Phosphate	Lb.	.08—.08½
Ultramarine, Blue	Lb.	.15— .35
White Precipitate (Mercuric-Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	.. —30.00
Whiting (American)	Ton	.. —30.00
Zinc Sulphate, com.	Lb.	.04¼—.04¾
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.10—.11½
Zinc Stearerate	Lb.	.. — .75

Organic.

Acetanilid, C. P.	Lb.	.45— .50
Acetic Acid, glacial, carboys, f.o.b. Shawinigan Falls	Lb.	.. —.20½
Acetic Acid, glacial, bbls., f.o.b. Shawinigan Falls	Lb.	.. — .20
Acetic Acid, 28%, carload lots	Lb.	.. — .04
Acetic Acid, 28%, 25 bbl. lots	Lb.	.. —.04¼
Acetic Acid, 28%, 10 bbl. lots	Lb.	.. —.04½
Acetic Acid, 28%, 5 bbl. lots	Lb.	.. —.04¾
Acetic Acid, 28%, 1 or 2 bbl. lots	Lb.	.. — .05
Acetic Acid, 80%, carload lots	Lb.	.. — .12
Acetic Acid, 80%, 25 bbl. lots	Lb.	.. — .14
Acetic Acid, 80%, 15 bbl. lots	Lb.	.. — .15
Acetic Acid, 80%, 10 bbl. lots	Lb.	.. —.15½
Acetic Acid, 80%, 5 bbl. lots	Lb.	.. — .16
Acetic Acid, 80%, 3 or 4 bbl. lots	Lb.	.. — .17
Acetic Acid, 80%, 1 or 2 bbl. lots	Lb.	.. —.17½
Acetone, pure, drums or over	Lb.	.. —.19½
Acetone, pure, lesser amounts	Lb.	.. — .25
Aspirin, in 100-lb. lots	Lb.	1.10— 1.15
Alcohol, Absolute Ethyl, case of 1 doz.	1-lb. bottle	.. — 2.15
Alcohol, Absolute Ethyl, in steel drums of 10 gallons capacity	Imp. Gal.	.. —15.00
Alcohol, acetone, bbls. or over	Gal.	.. — 1.35
Alcohol, acetone, lesser amounts	Gal.	.. — 1.60
Alcohol, pure, bbl., 65% O.P.	Gal.	.. —10.50
Alcohol, methylated, bbl.	Gal.	.. — 3.50
Alcohol, wood, 95%, bbls. or over	Gal.	.. — 1.15
Alcohol, wood, 95%, half bbl. lots	Gal.	.. — 1.25
Alcohol, wood, 95%, lesser amounts	Gal.	.. — 1.30
Alcohol, wood, 97%, bbls.	Gal.	.. — 1.20
Alcohol, wood, 97%, half bbl. lots	Gal	.. — 1.35
Alcohol, wood, 97%, lesser amounts	Gal.	.. — 1.50
Amyl acetate, technical	Gal.	4.50— 5.00
Amyl acetate, pure	Gal.	5.50— 6.00
Benzaldehyde	Lb.	1.35— 1.60
Benzoic Acid	Lb.	.85 — .90
Caffeine, English	Lb.	.. — 8.40
Calomel (Mercurous Chloride)	Lb.	.. — 1.25
Camphor, refined, slabs	Lb.	.. — 1.25
Camphor, refined, tal	Lb.	.. — .98
Carbolic Acid, white crystals	Lb.	.18— .20
Chloroform	Lb.	.40— .50
Citric Acid, domestic, crystals	Lb.	.65— .70
Coumarin	Lb.	3.90— 4.00
Cream Tartar, 98%	Lb.	.25— .30
Dextrine, potato	Lb.	.. — .06
Dextrine, corn	Lb.	.. —.08½
Ether, B.P. (conc.)	Lb.	.. — .55
Ether, Sulphuric	Lb.	.28— .38
Furmaldehyde, bbls. or over	Lb.	.. — .14
Formaldehyde, 200-lb. kegs	Lb	.. —.18½
Formaldehyde, 100-lb. kegs	Lb	.. —.19½
Formaldehyde, 50-lb. kegs	Lb.	.. —.20½
Formic Acid, 75%	Lb.	.40— .42
Fusel oil, special	Gal.	5.00— 5.25
Fusel oil, refined	Gal.	.. — 6.00
Gallic Acid	Lb.	1.25— 1.75
Glycerine, C.P., single tin of 56 lbs.	Lb.	.. — .26
Glycerine, C.P., two or more tins	Lb.	.. — .24
Glycerine, (pale straw), single tin 56 lbs.	Lb.	.. — .25
Glycertine, (pale straw), two or more tins	Lb.	.. — .23
Glycerine, C.P. drums, 500-1,000 lbs.	Lb	.. — .18
Glycerine, pale straw, drums, 500-1,000 lbs.	Lb	

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TABLE OF CONTENTS

EDITORIALS:

Page

Co-Operation and the Lesser Fleas 193

Rubber in Canada 193

The Right Kind of Commission 194

Is Protection Holding Us Back 194

Putting In or Taking Out 195

Correspondence 195

The Absorption of Gasoline from Natural Gas—II.
By R. C. Cantelo 196

American Electrochemical Society to Meet at Montreal 200

The Determination of Cobalt and Nickel in Arsenide Ores.
By C. A. Krittell 201

Page

The Bituminous Sands of Alberta.
By R. A. Clark 203

A New Source of Soapstone in Ontario.
By H. S. Spence 205

Exhibition of Fine Chemcals at London 206

New Books Reviewed 207

New Members of Institute 207

Mining and Metallurgy in British Columbia 207

Northern Ontario Notes 208

World Conditions and News in Chemical Fields 209

Industrial Developments 210

Production of Iron and Steel in Canada 210

Market Review 41

Index to Advertisers 52

Buyers' Guide 44

FROM THE PUBLISHERS—

THE VALUE OF TECHNICAL JOURNALS

The average chemist, engineer, teacher or superintendent of manufacturing does not often stop to realize the value that some specific technical publication may be to him personally, and the profession or business he represents.

Suppose publishers and societies ceased to print scientific literature. Suppose all the journals and technical books upon which you now depend so confidently were destroyed. How long would it be before the ordered progress of science and research fell down completely?

The best laboratories have the largest libraries and receive the most journals. The same is true for the individual. If you are not a user of such literature, if it's not making dividends for you, it is more than likely that you are not very much on fire about anything, and can well be classed as a drifter in the stream of science.

The mere recording of scientific and industrial literature of this type is a great work, while the ideas expressed by the editorial staff and contributors are moulding your opinion and shaping the direction of future progress.

We would be happy to know that you considered this paper a living thing, which supplied you regularly with a stimulating mental diet, and a personal friendliness for us.

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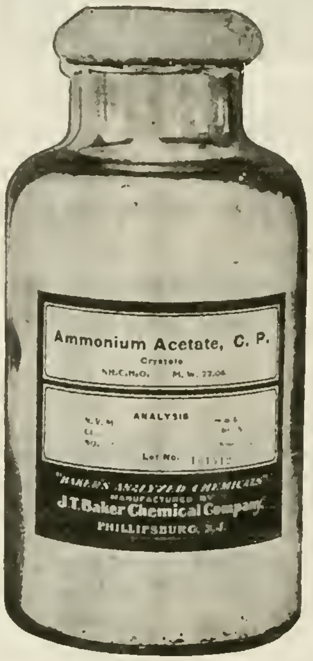

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EDITORIALS.

CO-OPERATION AND THE LESSER FLEAS

"SMALL fleas have lesser fleas upon their backs to bite them, and these again have other fleas, and so on ad infinitum."

Butler's reference to fleas is a very concise summary of a disturbing condition, which causes Sir Andrew McPhail to indulge in pessimistic remarks to the pulp and paper men as to the destruction of forests by insects, and a recent magazine writer of prominence to point out the danger in which humanity stands, of being eaten out of house and home by organisms ad infinitum that are attacking our food and clothing supplies. The magazine article points out that attacks upon certain classes of pests lead to the development of new generations immune to the treatment.

Apparently, the proper line of attack is not defensive, but offensive warfare, aiming at annihilation as quickly as possible by concentrated attack. Insect life is apparently analogous to animal life in its gradual toleration of increasing doses of toxic substances. We recall a cartoon showing President Roosevelt attacking the "Trusts." The latter was lying on its back and the Colonel was striking a knife into it saying: "Take that! and that!" while the "Trusts" was saying: "Oh! Teddy, how you tickle me." Our dealings with the insects seem to have much the same effect. We've got to make the earlier doses lethal.

The grape growers in co-operation have successfully beaten off the grape leaf hopper for this season, but he will come up again next.

We have large supplies of arsenic in Canada. What has been a metallurgical nuisance, may be one of our best weapons of offense, but it must be used continuously, properly, and in sufficient quantities.

The Niagara grape growers, have taken the first step, that is co-operation. The next step, investigation, suggests the setting up of laboratory and incubation facilities with means for establishing the most effective use of the right mixtures. We mention this matter because it has a much wider bearing. All our operations of husbandry, mining, manufacturing, marketing and transporting are becoming more complex, more inter-related, and consequently more delicate and more readily disturbed by failure in any department. The determining factor in commerce has until now been that of profit or margin of selling price over cost.

Hereafter the question of profit must mean more. For example it is not a nationally profitable thing for a man to chop down a nice young spruce tree that costs him nothing, and sell it for a dollar as a Christmas tree. It is not nationally profitable to throw away half the wood we use for pulp because it is only commercially profitable to save the fibre, nor is it nationally profitable to throw away our excess arsenic because it is not commercially profitable to recover and market all of it.

Further, it is not reasonable to throw all the burden and expense of saving arsenic for instance upon one industry, but as there is good use for all the arsenic we can obtain, it would be profitable that there be established a liaison between the miners and smelters of arsenic, the growers of grapes, the producers of germicides and those who transport both minerals and germicides.

RUBBER IN CANADA

DO you remember when Dr. Pulham Threw in the village, got a rubber-tired buggy? He was a nice young man too, but I don't believe Stella Settercap would have married him if he hadn't put one over all the other boys in town getting a rubber-tired buggy. That was only twenty odd years ago, and prior to that, for about forty years, there had been little change in the vehicle the village catch had used in courtship days.

Doc Threw would have stood little show to-day with his buggy. He'd have to run a Boiled-Rice car with two spare tires stuck on behind.

Two things have altered in twenty years the traction ideas of the previous seventy-five. One of these is the internal combustion engine, the other is the pneumatic tire.

It would be hard to imagine the motor industry of to-day without rubber. The rubber industry witnesses not only a triumph of science, but a justification of keen foresight in the development of a system of rubber plantations, wherein, as Sir William Pope so ably pointed out in his presidential address last year at Montreal, the rational method of utilizing the energy of the sun in natural synthesis was vindicated as compared with the expensive laboratory synthetic method of Germany.

There are numerous uses for rubber, but none have the quantity value of the tire industry, and few branches of industry have developed to such an extent. For example, in Canada in 1910, there was a motor vehicle for every 120 persons, to-day one for every 21 persons. The Canadian Rubber Industry then had an investment of $8,000,000, employed 5,000 workers, imported

$2,400,000 worth of crude rubber, and sold $5,000,000 worth of product. Now its capitalization here is $5,000,000, employing 15,000 workers, importing about $20,000,000 worth of crude, and the output is about $56,000,000. Latest statistics show that Canada is driving more cars than any other country except the United States.

Incidentally it will be noted that three times the employees turn out more than ten times the product, showing the value of more modern methods, larger plants, and more scientific co-ordination. Another interesting point is that, if the figures are correct, one dollar's worth of crude made two dollars' worth of product in 1910, while a dollar's worth of crude to-day, yields nearly three dollar's worth of product.

Superficially it might be considered that as rubber is not produced in Canada, the rubber industry is not one for Canadian capital, but when we consider that the crude rubber represents only about one-third the value of the finished goods, and that with the exception of sulphur the other two-thirds are made up of Canadian products, and labor, and when rapid growth, and development of an export trade are also noted, it is apparent that rubber is destined to be one of our leading industries.

THE RIGHT KIND OF COMMISSION

IN the conference on Ontario's iron ore problems held in July, very practical suggestions were offered and resolutions adopted.

The gist of these was first an adequate systematic survey, which has not been made yet, and second, the co-ordination of production and transportation conditions. A model commission was suggested, which is likely to be named, as the Hon. Harry Mills, Minister of Mines, is a man of action and will have the backing of a cabinet that is in sympathy with development.

A commission was suggested, a geologist, a blast furnace operator, or metallurgist, and a representative of transportation interests. That's the right kind of an iron ore commission, no M.Ps., judges, or other fillers, and it ought to register some definite accomplishments.

If there were no coal or iron to be had from outside, we would have found means to mine our own, and make it accessible to the country. The time is not far off when we shall have to. There is no good reason why that time should find us without satisfactory methods of dealing with the metallurgy, engineering, production, and transportation of those two bread and butter industries.

One of the best ways of getting facts into relation is that of the properly constituted commission. Such an one as that mentioned, with authoritative backing can do much. We hope to see it working soon.

IS PROTECTION HOLDING US BACK?

IT is seldom our custom to discuss the tariff; but we are of the opinion that since every interest has its say and influence in this direction, it is perhaps not out of order to introduce the question occasionally, as the fashion in this matter is class selfishness.

Referring particularly to chemical engineering equipment, and a great many types of modern machinery not made in Canada, is it reasonable to place a duty of twenty-five or thirty per cent. on imports, and what is the result? Recently, a large American firm, manufacturing specialized equipment, stated that in the past year they had some twenty inquiries from Canada that would certainly have resulted in sales, except for the duty. Their Canadian business for this reason alone is not worth considering. Now, our industries are handicapped relatively by the lack of this equipment. It may be that they should argue that their products are protected and they can, therefore, afford to pay duty on their machinery. This happy theory does not always work out, and if it did, what virtue is there in such an arrangement?

It is nonsense to think that an American firm is going to manufacture in Canada until there is a guaranteed local consumption of some magnitude. When they do, their local prices are apt to be based on the protected price. Chemists will appreciate the length to which this has gone when they realize that on scientific dictionaries, there is a duty, in spite of the fallacy that scientific books are free. The instruments of research, much of the book literature and all specialized equipment, bear a very high tax. Who is there, for example, in Canada, that would worry if the duty were taken off certain grades of analytical balances, microscopes, or filter paper? Why educate a boy in a world of duty-free apparatus and ask him to make his living in a world of duty-paid apparatus?

When Canada becomes a very large user of some special machinery, the foreign manufacturer may make arrangements with some Canadian foundry or machinery organization; but this does not always place the Canadian buyer on the same footing as his opposition in the country of original manufacture.

It seems to us that those machines which are so highly specialized that they may have only a few buyers in a particular industry, and yet are of tremendous importance in their way, should not be protected until there is some specific demand for such action. We are now protecting things that no one would dream of manufacturing here. Where is there a publisher in Canada that wishes to compete for example with Allen's "Commercial Organic Analysis" or thinks he would like to get out a Canadian edition of Thorpe; or a manufacturer who will undertake to produce five per cent. of the chemical equipment listed in the standard catalogs of England and America? The duty is so high that it defeats its own end as a revenue producer. The result is discouragement to engineers and companies in Canada and the delay of the development of our business and resources. We invite discussion on these points and would take the stand that a maximum duty of five per cent. should be ample on any such machinery not made in Canada, and that every book on chemistry in any language should be duty free to all. Why protect an industry which does not exist, or exclude from Canada the products of firms which are sole world manufacturers?

We invite chemists and engineers to seek answers for these questions before the Tariff Research Department of the Minister of Finance, just to get a line on the general conception and specific knowledge of special industries, which exists in that quarter.

We believe in free trade in materials we need and cannot make, whether they be tropical fruits or the finest and most complicated mechanical triumph. When someone in Canada appears to be able and willing to supply our requirements, it will be time enough to think of thirty per cent. protection.

PUTTING IN OR TAKING OUT

EVERYBODY knows some jolly fellow who keeps things going. We've seen him on regatta and sports days. He's everywhere starting races, getting entries, and encouraging the also rans. We saw one the other day; he carried a megaphone most of the time, and when he didn't his hand went to his chin just as if one was still there. In the evening he was supplying the chairman with prizes, passing trays of ice cream cones, and joining in the community singing. I didn't see him get anything all day, nor hear of his getting any vote of thanks, but he said he'd had a glorious day.

Now the secretary of the C. I. C. has sent out a news letter to the members about the winter's work, and it strikes us that when everything is summed up what the Institute, and every other organization for that matter, wants, is the member who doesn't worry so much about what he can get out of the Institute, but what he can put into it—the other things will be added unto him naturally, but success for the organization is what best pleases such members.

CANADIAN GRAPHITE

We have an idea that the graphite business in Canada is going to spring into considerable prominence in the not far distant future. World resources are not remarkably large, and the famous deposits of Ceylon, and, to a lesser extent, Madagascar, may yet have some real competition from our Canadian deposits. Time is working in our favor, and science and business management, which means co-operative production, should be sufficient to place the Canadian product on the map. Flake graphite is one of nature's rare gifts and while we have nothing that lends itself to easy exploitation, we have something that will last some time when it gets going. If it is true in any sense that Ceylon production may not be so easy to maintain in future as has been the case in the past, it means that Canadian graphite will take its place.

CORRESPONDENCE

The Editor,
CANADIAN CHEMISTRY AND METALLURGY

Dear Sir,

With reference to the proposed name for professional chemists: "Chemor" is not so bad when one gets used to it, although one cannot help feeling that a lady Chemor would be a "Chemise" in spite of everything. "Chemistor" and "Chemicor" are too awful for words.

Why not "Alchemist."

The alchemists were the fathers of our craft, and their researches for the Elixer of Life, and Philosopher's Stone, however crude, laid the foundations of modern scientific knowledge.

The modern research and industrial chemist may not transmute lead into gold, but, in a hundred industries, he is turning waste into wealth, and the production of dyes from coal tar, to quote only one instance, is as wondrous a transmutation as anything the old alchemist ever attempted.

"Alchemist" may also be considered as a contraction of analytic-*Al chemist* industri-*Al chemist* and so on.

The accent being on the first syllable, there is nothing to suggest a vendor of wallpaper, soft drinks, kodaks and stationery.

Finally "Alchemist" has the sanction of age, is brief, easily spoken and remembered, and is free from any suspicion of freakishness.

Yours truly,
E. DOUGLAS BROWN

Goderich, Ont., August 16, 1922.

AMERICAN BRANCH FACTORIES IN CANADA ARE INCREASING

The establishment of American branch factories in Canada continues this year to a greater extent than ever. Among the American industries to locate in Canada within the past few months have been a copper and brass concern at Toronto, cutlery manufacturers at Hamilton and Welland, electric bulbs at Oshawa, hosiery at Guelph, automobile plants at Sarnia and Windsor, silk mills at Cowansville, auto tire plant at Hamilton, silk dyeing and finishing at Drummondville, and textile dyeing at St. Johns.

The Absorption of Gasoline from Natural Gas—II*

Calculating Amount of Absorbent Necessary for Complete Removal of Gasoline from Gas—Results of Experiments.†

By R. C. CANTELO

TABLE II. gives the results of a test carried out by Mr. Dowling on the casing-head gas of the Dingman No. 2 well at Okotoks. Four absorbers were used. At the end of the test, the oil was transferred from the absorbers to cans which were sealed and expressed to the writer at Ottawa, for a determination of the gasoline content of the oil. From the values obtained, the yield of gasoline per 1,000 cubic feet of gas was calculated.

TABLE II
TEST No 6—WELL No. 2

Absorbent Used	Mineral Seal Oil			
No. of Absorber	1	2	3	4
Oil Used, c.c.	2840	2840	2000	2270
Specific Gravity of oil used, $\frac{15.5°C}{15.5°C}$	0.842	0.842	0.842	0.842
Gas used, cubic feet	166	166	166	166
Specific Gravity of recovered oil $\frac{15.5°C}{15.5°C}$	0.834	0.837	0.839	0.837
Total gasoline obtained from test, c.c.	149	73	36	35
Gasoline from each absorber, pints, per 1,000 cubic feet of gas.	1.9	0.9	0.5	0.4

The above test shows that the gasoline was not completely removed from the gas, even when the latter was passed through four absorbers in series. The writer's interpretation of this was that the amount of absorbent oil used in the absorbers was not sufficient to remove the hydrocarbon vapors. It is evident, therefore, how important it is to be able to calculate the amount of absorbent necessary for the complete removal of the gasoline vapors.

The writer determined the specific gravity of the gasoline from each absorber. On account of the small quantity of gasoline recovered by its distillation from the absorbent oil, the specific gravities were determined in a modified Saunder's oil-burette[19], and hence are only approximate. The results follow: (Table III.).

TABLE III

No. of Absorber	1	2	3	4
Specific Gravity of recovered gasoline $\frac{22°C}{22°C}$	0.75	0.68	0.67	0.67

The explanation of the decreasing specific gravity is evidently that the oil in the first absorber became saturated with the lighter hydrocarbons and hence ceased to absorb these vapors, while continuing to absorb those of the heavier hydrocarbons. The oil in the remaining absorbers continued to remove the lighter hydrocarbons.

Now it is well known that in many cases, the vapor pressures of liquid mixtures can be expressed as simple functions of the composition. For a number of pairs of liquids, usually where the liquids are closely related, a very simple equation connects the vapor pressure of the solution with its composition. Such pairs of liquids are: chlorbenzene and brombenzene; ethyl propionate and ethyl acetate; benzene and toluene; N-octane and N-hexane, etc.

For these pairs of liquids the equation

$$p = P_1X_1 + P_2(1 - X_1)$$

holds,[20] where p is the total vapor pressure above the solution P_1 and P_2 are the vapor pressure of components one and two in the pure state; and X_1 is the mole fraction of component one in the liquid.

A solution of natural gas gasoline in a mineral oil absorbent is one in which the two liquids closely resemble each other, both being mixtures chiefly of paraffin hydrocarbons. It appeared highly probable, therefore, that the equation $p = P_1X_1 + P_2(1-X_1)$ could be applied to such a solution. For mineral seal oil at ordinary temperatures, $P_2 = O$ so that the equation simplifies to $p = P_1X_1$.

The writer, therefore, carried out experiments to show that the equation $p = P_1X_1$ can be applied to a solution of natural gas gasoline in mineral seal oil. This necessitated—

(a) The determination of the vapor pressure of a mixture of the lower paraffin hydrocarbons.

(b) The determination of the vapor pressure of the above mixture from its solution in mineral seal oil.

(c) The determination of the average molecular weight of the mineral seal oil used.

Experimental:

As only a few cc. of natural gas gasoline were at the writer's disposal, he fractionated about five pounds of petroleum ether using a rod and disc stillhead,[21] and collected the fraction boiling below 60° C. An analysis of the distillate by the Dean method[22] gave the following:

1st Drop at	35°C.
10% at	37.5
20% at	39.0
30% at	41.5
40% at	43.0
50% at	47.0
60% at	49.0
70% at	52.0
80% at	55.0
90% at	60.0
96.5% at	65.0
3.5% Loss	

Barometer 761 mm.

The Specific Gravity $\frac{15.5°C}{15.5°C}$ of the distillate was 0.645. From a consideration of the boiling points of pentane and hexane, it is evident that the distillate is a mixture chiefly of pentane and hexane.

An analysis of the Mineral Seal oil used gave the following:

Specific Gravity $\frac{15.5°C}{15.5°C}$—0.841.

Distillation in 300 cc. flask by continuous method:
1st drop at 276°C.
2.2% Distilled up to 295°C.

Determination of Vapor Pressure

The common methods of determining vapor pressure are the static and the dynamic. The static method was used by Raoult[23] in his classic research on etheral solutions. It was also used by Konowalow[24] in his investigation on the vapor pressure of water with the lower alcohols and fatty acids. Frazer and Lovelace[25] made use of a manometer designed by Lord Raleigh[26] for the determination of vapor pressure lowerings in the case of very dilute solutions. Campbell[27] also applied the method with the use of a specially designed apparatus.

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*This is Part II and concluding instalment of this article Part I dealing mainly with the theory and development of the absorption process appeared in the August, 1922, issue of CANADIAN CHEMISTRY AND METALLURGY

†Experimental data taken from a Thesis presented to Queen's University, Kingston, Ont., in 1920

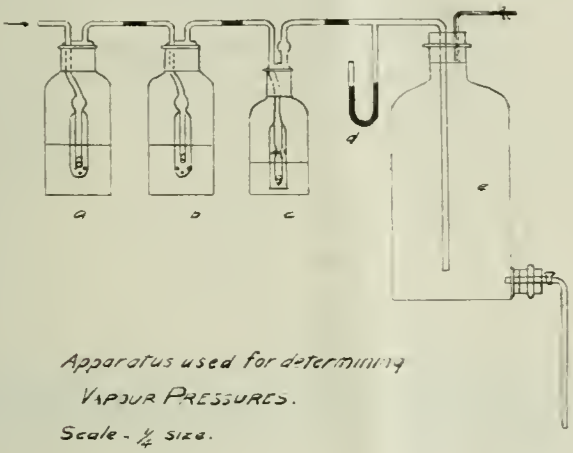
The dynamic method has been used with varying degrees of success by Regnault[28], Linburger[29], Perman[30], Price and Perman[31], Derby, Daniels and Gutsche[32], Lincoln and Klein[33], Krauskopf[34], Walker[35], Will and Bredig[36], Berkeley, Hartley and Burton[37], Washburn and Heuse[38].

Where this method is used for the determination of vapor pressures and not of relative lowering, it consists essentially in passing a known volume of air or indifferent gas through or over the liquid or substance whose vapor pressure is to be determined and by determining the amount of substance carried over, the vapor pressure is readily calculated from Dalton's Law of Partial Pressures. The air drawn through the apparatus must necessarily be saturated with the vapors and herein lies one of the chief difficulties.

However, when the vapor pressures of the liquid to be investigated are comparatively high as in the case of solutions of natural gas gasoline in mineral seal oil, the error due to lack of saturation will be small.

Apparatus and Method Used

The apparatus used by the writer for the vapor pressure determinations is shown in the figure.



Apparatus used for determining Vapour Pressures.

Scale - ¼ size.

a and b are gas-washing bottles containing concentrated sulphuric acid; c is an Allihn's gas-washing bottle containing the solution whose vapor-pressure is to be determined; d is a pressure gauge and e is a calibrated Mariotte bottle containing a saturated solution of sodium chloride. During an experiment a, b and c were contained in a thermostat kept at constant temperature.

The procedure of experiment was as follows: A quantity of the mineral seal oil was weighed into a flask. A quantity of the gasoline was then weighed in a pycnometer and some was transferred to the flask containing the mineral seal oil. The flask was immediately corked and was shaken well to insure solution. The amount of gasoline used was determined by the difference in the weights of the pycnometer before and after the transference of the gasoline. A quantity of the solution was transferred to the saturator c, the whole weighed, and the saturator was immediately connected to the train. The train was allowed to remain in the thermostat for one half hour before beginning the experiment, then air was drawn through at constant pressure, by means of the Mariotte bottle.

(N.B.—In the case of the vapor pressure determinations of gasoline alone, it was weighed directly into the saturator).

An experiment was continued usually until 1000 to 2000 cc. of air had passed through the apparatus. At the end of an experiment the volume of air + gasoline vapors was measured, and the saturator was weighed so that the loss of hydrocarbon vapors could be determined.

A determination of the vapor pressure of the mineral seal oil showed it to be negligible at the temperatures of the experiments.

The results of the vapor pressure determinations, together with other necessary data are given in Table IV.

TABLE IV.
VAPOR PRESSURE MEASUREMENTS. TEMPERATURE = 30°C.

Test No.	% by Weight of Gasoline in Solution	Loss in Weight of Saturator grm	Vol. of Gas Measured Over Salt Soln. c.c.	Room Temperature °C.	Vapor Pressure mm of Mercury
8	100	2.3088	1040	31.9	526
9	8.45	0.7054	1800	30.5	93
10	9.65	0.7667	1800	32.0	102
11	5.69	0.5183	1800	27.9	68
12	3.14	0.3068	1810	24.0	39
			TEMP. = 26°C.		
14	100.0	1.9022	1000	31.2	450
18	1.86	0.1611	1800	29.5	21
21	6.62	0.5329	1800	26.5	69
23	3.74	0.3124	1810	23.2	40

The method of calculation will be evident from the following example, in which the data obtained in Test No. 9 was used:

$$p_1 = \frac{n_1}{n} \times P$$

where p_1 is the partial pressure of gasoline vapors above the salt solution, which is also the vapor pressure of the solution of gasoline in mineral seal oil. p_1 is given in mm. of mercury;

n_1 = no. of moles of gasoline in vapor phase above salt solution,

and $n_1 = \frac{\text{Loss in weight of Saturator}}{80}$. The average molecular weight of the gasoline is assumed to be 80.

n = total number of moles in vapor phase above salt solution, and n = Volume of gas over salt solution calculated to standard conditions ÷ 22400. P = Pressure of gas within Mariotte bottle as indicated by manometer.

For test No. 9—

$$n_1 = \frac{0.7054}{80}$$

$$n = \frac{1800}{22400} \times \frac{273.1}{303.6} \times \frac{755}{760}$$

$$P = 755 \text{ mm.}$$

$$p_1 = \frac{0.7054}{80} \quad \frac{303.6 \times 760 \times 22400}{1800 \times 273.1 \times 755} \times 755 = 93 \text{ mm}$$

Determination of Average Molecular Weights

Before it is possible to apply the equation $p_1 = P_1X_1$, it is necessary to know the value of the mole fraction X_1; and this necessitates a knowledge of the molecular weights of the gasoline and the mineral seal oil.

From the analysis given on page 196, it is evident that the gasoline used in the experiments, was a mixture chiefly of pentane and hexane. Accordingly, the molecular weight of the gasoline was assumed to be 80, or approximately the mean of the molecular weights of pentane (72) and hexane (86).

In the case of the mineral seal oil, however, an actual determination of the value was necessary.

It is well known that substances in solution frequently "associate" to form complex molecules. Norman[39] determined the molecular weights of a series of petroleum oils by the depression of freezing point and elevation of boiling point methods; and he used benzene as solvent. His work showed that the tendency towards association of dissolved oil, not only existed in benzene, but that this tendency increased with increasing concentration of the solute. Thus, for an American oil of specific gravity 0.885, he obtained the following results:—

Concentration	Average Molecular Weight
0.15	262
0.42	292
0.69	304
1.01	310
2.00	318
3.33	321
5.15	328
7.17	334
9.19	343

This tendency of benzene to cause association of the molecules of a dissolved mineral oil, has recently been confirmed by Davis[40].

Graefe[41] obtained apparently normal molecular weights for a number of fractions from a lignite tar, by the freezing point lowerings of their solutions in stearic acid.

Ubblehode and Mecklenburg[42] carried out a thorough investigation of the methods used for determining molecular weights as applied to oils.

The following methods were used:—

V. Meyers' Vapor Density Method in an atmosphere of air.

V. Meyers' Vapor Density Method in an atmosphere of nitrogen.

Method of Elevation of Boiling Point in benzene.

Method of Depression of Freezing Point in glacial acetic acid.

Method of Depression of Freezing Point in stearic polmitic acid.

Their work showed that the depression of the freezing point methods were the most useful, while on account of the oxidation of the oil by air, the vapor density method in an atmosphere of air was least useful. When nitrogen was used in place of air, however, the errors were not much greater than with the cryoscopic method.

The elevation of the boiling point method gave values which diverged, not only very much amongst themselves, but also from the values obtained by the depression of the freezing point method.

Accordingly, the writer determined the average molecular weight of the mineral seal oil used by the freezing point lowerings produced by its solutions in stearic acid. The values obtained are given in Table V.

TABLE V.
STEARIC ACID SOLVENT

Concentration of Mineral Seal Oil in Stearic Acid	Average Molecular Weight
1.9	223
5.5	214
7.6	221
9.9	240

Although the above results up to 7% are in good agreement, it seemed advisable to check them, using another solvent. For this naphthalene proved the most satisfactory. The results obtained with naphthalene are given in Table VI.

TABLE VI
NAPHTHALENE SOLVENT

Concentration %	Average Molecular Weight
1.6	223
2.9	219
4.6	225
5.2	214
7.2	247
9.1	245

The above values up to a concentration of 5% are in very fair agreement not only with one another, but also with the values obtained when stearic acid was used as solvent. Accordingly, 220 was taken as the average molecular weight of the mineral seal oil.

Table VII. was calculated with the use of this value, and the data given in Table IV.

TABLE VII.
TEMPERATURE = 30°C. $P_1 = 526$ mm.

Test No.	% by Weight of Gasoline in Solution	Mole Fraction of Gasoline X_1	Vapor Pressure of Gasoline From $p_1 = P_1X_1$	Determined Vapor Pressure of Gasoline p_1	mm. Δ
12	3.14	0.0817	43	39	−4
11	5.69	0.143	75	68	−7
9	8.45	0.203	106	93	−13
10	9.65	0.218	114	102	−12
	TEMPERATURE = 26°C. $P_1 = 450$ mm.				
18	1.86	0.0499	22	21	−1
23	3.74	0.0964	43	40	−3
21	6.62	0.163	73	69	−4

The method of calculating p_1 by means of the equation $p_1 = P_1X_1$ will be evident from the following in which the data for Test No. 12 is used:

$$P_1 = 526$$

$$X_1 = \text{mole fraction of gasoline} = \frac{\text{moles of gasoline}}{\text{moles gasoline} + \text{moles mineral seal oil}}$$

Molecular weight of gasoline = 80

Molecular weight of mineral seal oil = 220

% by weight of gasoline in solution = 3.14

$$\therefore \text{Moles gasoline} = \frac{3.14}{80} = 0.0392$$

$$\text{Moles mineral seal oil} = \frac{96.86}{220} = 0.440$$

$$\therefore X_1 = \frac{0.0392}{0.0392 + 0.440} = 0.0817$$

$$\therefore p_1 = 0.0817 \times 526 = 43.$$

The calculated values agree fairly well with the observed values; so that, where gasoline vapors dissolve in mineral seal oil, the vapor pressure of gasoline above the solution may be fairly safely obtained by the use of the equation $p_1 = P_1X_1$.

The question now arises as to what use can be made of this relation.

The first use is that by means of it we can calculate the amount of mineral seal oil required to completely remove the gasoline from the gas.

Let us assume for the present that we wish to treat a gas for its gasoline content under atmospheric pressure. It can be shown later what the effect of high pressure will be.

Let us assume also, for purpose of illustration, that we have carried out a small scale test upon a well using so large a volume of absorbing oil as to inhibit saturating it with pentane and hexane, and that by distilling off the absorbed gasoline from a sample, we have found that the gas contains three pints of gasoline per 1,000 cubic feet. Suppose, then, that a careful fractionation of the gasoline showed its composition to be 75% pentane and 25% hexane. Then from 1,000 cubic feet of the gas under consideration, we can obtain 2.25 pints of pentane and 0.75 pints of hexane. By means of the gas laws we can calculate the partial pressures of these constituents in the gas.

These are:—

Pentane	... 7.14 mm.
Hexane	... 2.11 mm.

From the vapor pressure curves for normal pentane and normal hexane[43] P_1 can be obtained for any temperature, and by means of the equation $p_1 = P_1X_1$, the percentage of pentane and hexane, respectively, which when dissolved in mineral seal oil, gives a vapor pressure equal to the respective partial pressure in the gas, can be calculated.

Thus $p_1 = 7.14$ mm. for pentane

$$X_1 = \frac{p_1}{P_1}$$

For 0°C. $P_1 = 185$ mm. for pentane.

$$\therefore X_1 = \frac{7.14}{185} = 0\ 0385$$

i.e. 1 mole of solution contains 0 0385 moles of pentane, and 0.9615 moles of mineral seal oil.

∴ The % by weight of pentane in solution

$$= \frac{0.0385 \times 72 \times 100}{(0.0385 \times 72) + (0\ 9615 \times 220)} = 1\ 28$$

Table VIII. was calculated in this way:

TABLE VIII.

Product	Vapor Pressure in solution mm.	Percentage by weight of product to give vapor pressure given in Column 2			
		0°C	10°C	20°C	30°C
Pentane..............	7.14	1 28	0 85	0.57	0.38
Hexane..............	2.11	1.85	1.09	0.68	0.44
Ratio..............	$\frac{\%\ \text{Hexane}}{\%\ \text{Pentane}}$	1.45	1.28	1.19	1.16

It will thus be seen that at 0°C. the oil can dissolve 1.45 times as much hexane as pentane, 1 28 times as much at 10°C., and so on. Hence the quantity of oil which completely removes all the pentane from 1,000 cubic feet of gas at 0°C., can wash the hexane from 4150 cubic feet as the following calculation shows:—

1.000 cubic feet of gas yield 2.25 pints of pentane

$$= \frac{2\ 25}{8} \times 6\ 27 \text{ lbs. of pentane.}$$

$$\text{Ratio } \frac{\%\ \text{Hexane}}{\%\ \text{Pentane}} = 1.45$$

i.e. the quantity of oil which completely washes all the pentane from 1,000 cubic feet gas can remove

$$1.45 \times \frac{2.25}{8} \times 6\ 27 \text{ lbs. of hexane.}$$

$$1{,}000 \text{ cubic feet of gas yield } \frac{0.75}{8} \times 6\ 58 \text{ lbs. of hexane.}$$

∴ The quantity of oil which completely removes all the pentane from 1,000 cubic feet of gas at 0°C. can wash the hexane from:

$$\frac{1.45 \times 2\ 25 \times 6\ 27}{8} \div \frac{0\ 75}{8} \times 6\ 58 \times 1000$$

= 4150 cubic feet.

In this way, Table IX. was constructed, showing the relative quantities of gas from which the hexane can be completely washed by the quantity of oil necessary for complete removal of the pentane from 1,000 cubic feet of gas.

TABLE IX.

Temperature	Relative Quantity of Gas
0°C	4150
10°C	3660
20°C	3420
30°C	3310

It is evident, therefore, that theoretically, the gasoline can be completely removed at any temperature from the gas under consideration, by washing with that amount of oil which will yield a solution having a vapor pressure of pentane at that temperature, equivalent to the partial pressure of pentane in the gas.

Table X. gives the calculated gallons of fresh mineral seal oil required per 1,000 cubic feet of gas to completely remove the gasoline.

TABLE X.

Temperature	Gallons Mineral Seal Oil per 1,000 cubic feet of gas
0°C	16
10°C	25
20°C	37
30°C	55

We have next to consider the case in which the gasoline is treated under pressure. The effect of increased pressure will be to increase the partial pressure of pentane in the gas, and hence the amount of wash oil will be correspondingly decreased. In other words, the amount of oil required will decrease proportionately with the increase in pressure.

It is interesting to note in this connection, the figures suggested by Burrell and his associates as a result of their commercial tests.[44]

Pressure	Imperial gallons of oil per 1,000 cubic feet
Atmospheric	50 (to give 80% of maximum extraction)
25 lbs. per square inch...	25—40
200—240 per square inch.	3— 6

N.B.—Their maximum extraction was about two pints per 1,000 cubic feet of gas.

Davis[45] as a result of his study of the absorption of benzene from coal gas, concludes that the efficiency of an oil for absorbing a vapor from a gas depends upon the power of the oil to lower the vapor pressure of the extracted substance from its solution in the oil. From the results of his experimental work, he concludes also that "the determination of the molecular weight of an oil when dissolved in benzene seems therefore to afford a good method for testing the efficiency of the oil for absorbing benzene or other vapors from gases; the lower the molecular weight, the greater the efficiency."

The writer has shown that the equation $p_1 = P_1 X_1$ holds for a solution of gasoline in mineral seal oil.

The relative lowering of the vapor pressure can be obtained from the above equation.

$$\frac{\Delta P_1}{P_1} = \frac{P_1 - P_1}{P_1} = \frac{P_1 - P_1 X_1}{P_1}$$
$$= 1 - X_1 = X_2$$

X_2 is the mole fraction of mineral seal oil in solution.

This means that fractional lowering of the vapor pressure of gasoline from its solution in an absorbent oil is inversely proportional to the molecular weight of the absorbent oil; and is in agreement with Davis' conclusion.

This fact will be more evident if we calculate the relative vapor pressure lowering for, say, a 10% solution of pentane in a series of oils of different average molecular weights. Table XI. gives $\frac{\Delta P_1}{P_1}$ for such solutions.

TABLE XI.

Average Mol. Weight of Absorbent Oil	$\frac{\Delta P_1}{P_1} = X_2$	Fraction of Vapor Pressure Left
150	0.827	0.173
200	0.783	0.217
250	0.733	0.267
300	0.705	0.295

It should be pointed out, however, that no matter what is the average molecular weight of the oil at the start, as the butane, propane, pentane and hexane are dissolved by the absorbent oil, the average molecular weight of the absorbent is lowered, thus increasing its efficiency.

Let us, before closing, consider the thermal effect of the solution of gasoline in mineral seal oil. This involves a knowledge of the heat of dilution of the solution.

For any solution we have the equation:

$$h_d = l_r - l$$

where h_d is the differential heat of dilution per gram of gasoline, l_r is the latent heat of evaporation of one gram of gasoline from an infinite amount of solution of composition r and l is the latent heat of gasoline.

Now the equation $p_1 = P_1X_1$ is the equation for the vapor pressure of any constituent above an ideal[46] solution. For such solutions $h_d = O$, so that we can write l for l_r. l can be calculated easily from the integrated Clapeyron equation:

$$Ml = 2.303 \frac{RT_1T_2}{T_2 - T_1} \log_{10} \frac{P_2}{P_1}$$

From Table VII we have:

$$T_1 = 303.1$$
$$T_2 = 299.2$$
$$p_1 = 525 \text{ mm.}$$
$$p_2 = 450 \text{ mm.}$$

Also $R = 0.0821$ litre-atmospheres per degree and for the gasoline in question, $M = 80$.

Substituting these values in the equation, we obtain $l = 87 \frac{\text{grm. cal}}{\text{grm.}}$

In 1,000 cubic feet of the hypothetical gas we have been considering there are $\frac{2.25 \times 627 + 0.75 \times 6.66}{8} \times 453.6$ gms. of gasoline.

The heat liberated by absorption of this amount of gasoline would be $\frac{2.25 \times 6.27 + 0.75 \times 6.66}{8} \times 453.6 \times 87$ gram calories.

For complete removal of the gasoline, we require at 20°C. 37 gallons of mineral oil absorbent, or $37 \times 8.42 \times 453.6$ grams.

The heat liberated by the gasoline therefore, would heat the mineral seal oil through about 1.5°C. assuming that the specific heat of the absorbent oil equal 0.5. Actually the increase in temperature would be less, as the heat evolved on complete absorption of the gasoline would go to heat, not only the absorbent oil, but also the 1,000 cubic feet of natural gas.

It is evident, therefore, that the thermal effect of the absorption of the gasoline need not be considered in calculating the amount of absorbent oil for complete removal of the pentane vapors.

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AMERICAN ELECTROCHEMICAL SOCIETY TO HOLD MEETING IN MONTREAL, SEPTEMBER 21, 22 AND 23, 1922

Final arrangements for the Forty-second General Meeting of the American Electrochemical Society, at Montreal, Que., are being made which will make this meeting one of the best in the history of the Society.

The meeting will be opened by President Schluederberg on Thursday morning, (September 21) and the Technical program will proceed with the presentation and discussion of papers on Electrolysis and Electroplating. The recently organized Division on Electrodeposition (G. B. Hogaboom, chairman; Wm. Blum, Secretary) will be well represented and take active part in the discussion of these papers.

One of the papers of the Thursday morning session will deal with the physical properties of electrolytic iron—a product which is being turned out commercially, contrary to all predictions of ten years ago. There will also be papers on zinc, brass, and other electrodeposited metals.

On Thursday afternoon and Friday morning, a very interesting symposium on "Industrial Heating" will be in progress. The Electrothermic Division (Bradley Stoughton, Chairman; Colin G. Fink, Secretary) which held a most successful symposium on "Electric Cast Iron" at the Baltimore Meeting, in April last, will again be in charge. Twelve papers especially prepared for this session and dwelling on industrial heating in electric furnaces, other than fusion and melting furnaces, will be placed open to discussion.

There will be papers on:

a. History of Industrial Heating.
b. Principles of Design of Furnaces.
c. Comparison of Fuel Costs in Different Types of Electric Furnaces, and with Combustion Furnaces. (In this connection, Electric Energy would be estimated as a "fuel cost.")
d. Resister Materials.
e. Specific Heats.
f. Electric Conductivity of Insulating Materials at Industrial Furnace Temperatures.
g. Heat Emissivity.
h. Heat Transfer.

There will be an excursion to Shawinigan Falls, affording members a rare opportunity to inspect the various industrial plants of one of the most progressive centres on the continent. It is planned to have a special train for this all-day trip from Montreal.

A popular lecture on the Progress in Physical Science is scheduled for Thursday evening. Section Q will be in charge of an old-fashioned Smoker on Friday evening.

The headquarters for this Meeting will be the Hotel Windsor. Members and guests are urged to make their hotel reservations immediately.

USE OF PRESERVATIVES FOR MINE TIMBERS

The purpose of an investigation, just begun by the United States Bureau of Mines, in co-operation with the Forest Service Laboratory, is to determine the character and efficiency of preservatives used for mine timbers. Information will be gathered as to the present extent of the use of such preservatives in treating mine timber and as to their efficacy in the prevention of timber decay. Data will be obtained as to the cost and saving effected in mine timbering by the use of preservatives, the sources of supply of preservative material, and the extent of fire prevention afforded by certain preservatives and certain coverings. The investigation is to be conducted in connection with coal, metal and other mines. R. R. Hornor, consulting engineer, and H. E. Tufft, mining engineer, have been detailed to the investigation

The Determination of Cobalt and Nickel in Arsenide Ores

A Method Designed Particularly for Ore from the Cobalt District, Ont.

By C. A. KNITTEL

THE method described below is based upon well-known reactions and has been extensively used on ores from the Cobalt district. While it cannot be termed rapid, it is accurate and well adapted for umpire work. The writer has found that some of the shorter methods described in the literature do not give results of a high degree of accuracy, although they are useful for the control of works operations.

Preliminary Notes on Procedure

Examination of the silicious residues from approximately five hundred samples of ores and concentrates from the Cobalt district showed that proper treatment with acids rendered the cobalt and nickel completely soluble. The separation of large amounts of arsenic as sulphide requires prolonged treatment with hydrogen sulphide. The precipitate is bulky, requiring a large filter, and the consequent use of a large volume of washings. For this reason, the volatilization of the arsenic is preferred and the following schemes have been tried to accomplish this:

1. Digestion of the ore with hydrochloric acid saturated with bromine, followed by evaporation to a thick syrup. This was successful with some ores, others however, were not completely decomposed even with repetition of the treatment followed by evaporation to dryness.

2. Decomposition with conc. sulphuric acid will leave the arsenic in solution in the lower state of oxidation, and on addition of hydrochloric acid of the proper concentration followed by evaporation to fumes of sulphur trioxide, most of the arsenic will be expelled. This method is mentioned by Drury[1]. Decomposition by this treatment is not complete in all cases, some particles of ore being occluded by anhydrous sulphates formed during treatment.

3. Decomposition with nitric acid, expulsion of the nitric acid by (if necessary) repeated evaporation with hydrochloric acid to a syrupy consistency, followed by evaporating to dryness at a temperature just below boiling, with a mixture of equal parts of conc. hydrochloric acid and hydrobromic acid (d. 1.34) gives excellent results. On treating an ore containing over 52% of arsenic as outlined above, using 15 cc. of the mixture of hydrochloric and hydrobromic acids, the arsenic was found to be completely volatilized.

4. Decomposition with nitric acid, followed by evaporation to fumes with sulphuric acid, taking care to insure complete expulsion of the nitric acid, and repetition of the evaporation to fumes of sulphur trioxide after addition of a mixture of hydrobromic and hydrochloric acids proved uniformly successful.

5. The writer prefers to use the residue left in the distillation flask after the determination of arsenic as described in this Journal[2] If it is desired to determine the cobalt and nickel on a separate portion of material, the scheme as outlined under 4 is recommended. It can be carried out rapidly over a bare flame under a hood provided with a good draft.

A great deal has been written on the conditions necessary for the separation of iron and alumina from other metals by the basic acetate method. In the writer's opinion, the best summary as regards the separation of iron as basic acetate is given by Brearley and Ibbotson.[3] The writer's experience is in accord with the statements of these authors, and the practice of using such large quantities of acetate as given in Low[4] in the description of a method alleged to be in general use at Cobalt, Ont., is to be condemned.

Ores shipped from the Cobalt district in the early days were practically free from zinc, but in recent years, shipments, especially of concentrates and slimes, were found to contain from 0.2 to 1.2% of zinc. The presence of zinc in the solution from which cobalt and nickel are deposited by electrolysis is a serious source of error.

If the amount present is small, it is largely deposited with the cobalt and nickel. If much is present, it is partly deposited and imparts a dirty appearance to the deposit, and furthermore, it prevents the complete deposition of cobalt and nickel.[5]

The presence of zinc in more than traces can be usually detected by a faint white line, which will form on the side of the container at the surface of the solution when the cobalt and nickel are precipitated with hydrogen sulphide from a faintly acetic acid solution.

The writer has tried to get cobalt and nickel into a solution suitable for electro-deposition without resorting to a primary separation of the sulphides. Iron and alumina were separated as basic formates, zinc precipitated as sulphide from the filtrate containing definite amounts of free formic acid. The filtrate from the zinc was evaporated to fumes with sulphuric acid, and the cobalt and nickel deposited from the solution to which the usual excess of ammonia had been added. The presence of lime and magnesia did not seem to interfere with the electro-deposition. However, the zinc sulphide separated in the above manner always carried down small amounts of cobalt and nickel. Some experiments were made to find the proper conditions to prevent the co-precipitation of cobalt and nickel with the zinc, and although they were encouraging the work had to be abandoned on account of lack of time at the writer's disposal.

The separation of zinc as sulphide from faintly mineral acid solution has formed a subject for numerous investigators. The conditions for this separation, as described in the method presented, are suitable for the particular proportions in which the metals in question occur in the ores from the Cobalt district.

The precipitation of cobalt and nickel as sulphides from faintly acetic acid solutions is very quickly effected with hydrogen sulphide under pressure, and for this purpose the simple apparatus as described by Fuller[6] has been found very useful in this, and other separations involving the use of this gas. Pyrex flasks stand up under quite high pressures, and a number of precipitations can be run in series with a generator of one liter capacity. With a column of liquid in the pressure tube about one metre in height, the sulphides will separate in a granular condition in less than ten minutes, and if the filtration of the sulphides is proceeded with as quickly as possible, while the solution is still hot, the filtrate will generally be free from cobalt and nickel. However, one should never neglect to test the filtrate.

The separation of zinc sulphide from a faintly mineral acid solution is also hastened by precipitation under pressure. The flask containing the solution may be disconnected from the generator while retaining hydrogen sulphide under pressure, and allowed to stand for an hour or so with frequent shaking, when even minute amounts of zinc will be completely precipitated. Immediate darkening of the solution is due to either traces of copper or lead, the latter is prone to turn up at this stage, owing to a too liberal use of hydrochloric acid before the precipitation of the metals of the second group.

The electro-deposition from the simple ammoniacal sulphate solution is preferred to the numerous electrolytes containing inorganic or organic compounds which have been proposed from time to time. These additions are superfluous, if not harmful, and the writer has found that the presence of acetates retards the deposition of the last traces of nickel. The ammonia used should be free from pyridine and other organic bases, as small amounts of these impurities also retard electro-deposition. A trace of the metals, mainly nickel, is always retained in the electrolyte, and in order to keep this at a minimum the volume of the electrolyte is kept at 100 to 120c.c. C. M. Johnson[7] saturates the electrolyte after deposition with hydrogen sulphide, and assumes that any precipitate formed, consists of cobalt and nickel. However, this precipitate is generally strongly contaminated with constituents dissolved from the glass by the action of the ammoniacal solution. Paying attention to the various precautions mentioned above, the writer has found that the amount of combined metals remaining in the electrolyte will not exceed 0.0001g., and considering this small quantity does not favor doubtful corrections. Electrolytically deposited cobalt is more liable to contain oxygen than nickel deposited under similar conditions. The oxidation of the cobalt deposit is favored by high current densities, and the writer has found oxygen equivalent to as much as 0.2% in deposits weighing from 0.75 to 0.98g. To prevent this oxidation, various re-agents have been recommended, and among others, the writer has used sodium and ammonium bisulphite, but found that deposits produced in the presence of these salts were often contaminated with sulphur. When depositing large amounts of cobalt with high current densities, the addition of 1 to 2g. hydroxylamine sulphate has a beneficial effect, but in ore analysis where the amount of cobalt plus nickel ranges from 0.06 to 0.15g., and using the current densities as recommended, excellent deposits can be obtained without any addition agent whatever. The cathodes are of the perforated type with the following dimensions: Diameter of cylinder, 3.2 cm., height of cylinder, 5.0 cm., height over all, 15.0 cm., effective surface approximately 60 cm.^2 The anodes are spirals made of No. 18 wire, 1.5 cm. in diameter, six and a half turns, with stems of No. 15 wire, 10 cm. long.

With cobalt and nickel, in the proportions as found in the ores from the Cobalt district, a single precipitation with dimethylglyoxime from a solution faintly acid with acetic acid will give a precipitate free from cobalt. Sufficient of the dimethylglyoxime solution should be added to combine with the cobalt and nickel, usually four times as much dimethylglyoxime as the weight of the combined metals present is required. The solution should be diluted so that it contains not more than 0.1g cobalt per 100 c.c., and care should be taken that the amount of the alcoholic solution of dimethylglyoxime does not exceed one-third of the final volume.[8] As the precipitate is bulky, it is best to keep the quantitity of nickel to be precipitated below 0.08g.

Procedure

Treat 1g. of the ore in a 250 c.c. conical flask with 10 c.c. of conc. nitric acid and digest at a low heat until further action ceases. Add 5 c.c. of conc. sulphuric acid and evaporate to fumes. Cool, add 15 c.c. of water, and repeat the evaporation to fumes in order to insure the complete expulsion of nitric acid. Take up with 10 c.c. of water, and 20 c.c. of conc. hydrochloric acid, and, according to the amount of arsenic present, 5 to 8 c.c. of hydrobromic acid (d. 1.34), and once more evaporate to fumes, gently boiling over a bare flame. This can be easily done without any loss through spattering, by continuously rotating the flask during evaporation. A two-bulbed trap made from a calcium chloride tube as described by Gooch[9] is a very good device to guard against loss through spraying.

If the arsenic has been determined by the writer's method[10], add sufficient hydrogen peroxide or bromine water, to destroy the excess of hydrazine sulphate, to the residue left in the distillation flask, and evaporate to fumes of sulphur trioxide.

Having eliminated the arsenic by either method proceed as follows: Take up the sulphates with 50 c.c. of water, and heat, with constant shaking, until the anhydrous sulphates generally present have dissolved. Add 1 c.c. of conc. hydrochloric acid, and shake till any silver chloride which may separate has coagulated. Filter through a paper of suitable size, and wash with cold, dilute (1%) sulphuric acid, receiving the filtrate in a 250 c.c. conical flask.

The filtrate, which should be about 100 c.c. in volume, is heated, and saturated with hydrogen sulphide. Filter the small amount of sulphides of principally antimony and copper, and wash with hot hydrogen sulphide water containing a little sulphuric acid. Boil the filtrate and washings (which need not exceed 150 c.c.) to expel hydrogen sulphide, oxidize the iron with 5 to 10 c.c. of hydrogen peroxide, and boil again to expel the excess of peroxide added.

Cool the solution to at least 20°C., and while keeping cool, neutralize most of the free acid with ammonia. Continue neutralization with a (10%) solution of ammonium carbonate, drop by drop, with constant stirring, until a faint cloudiness persists, then add, drop by drop, dilute (25%) formic acid to just clear the solution. A little practice will enable one to recognize the right conditions, even when the liquid is quite dark. The intensity of the color of the solution will depend upon the amount of iron present, and also the degree of dilution.

Adjust the volume of the neutralized solution to about 200 c.c. heat to boiling, then add 10 c.c. of a (20%) solution of ammonium acetate, and continue boiling for about two minutes. Let the precipitate settle for a few minutes, and filter hot through a loose textured paper of suitable size, and wash the precipitate four times with hot water containing 2 g. of ammonium acetate per litre. Receive filtrate and washings in a flat-bottomed porcelain dish, and evaporate. Re-dissolve the precipitate with 50 c.c. of hot (1:4) hydrochloric acid, and receive the solution in the original beaker. Pour the hot acid back and forth, until the precipitate is completely dissolved from the paper, using as second container a small beaker, then wash the paper thoroughly with cold water. Neutralize as described above, and repeat the acetate separation in a volume of 200 c.c., filter, and wash the precipitate three times. Add the second filtrate to the first filtrate in the dish and evaporate to a volume of 150 c.c., and filter off any small amounts of iron and alumina which may have flocked out. The small precipitate should be washed with hot acetate wash-solution, and if it exceeds a few mg., it is dissolved, re-precipitated with ammonia from a small volume, and the filtrate added to the main solution. The amounts of iron and alumina separated at this stage, are generally negligible when the acetate separations have been properly conducted.

Separation of the cobalt, nickel, and possibly zinc, with hydrogen sulphide, is effected in a conical flask of 250 c.c. capacity. Neutralize the solution, which should have a volume of 150 to 180 c.c., with ammonia. Add 1 cc. of glacial acetic acid, heat to boiling, and saturate with hydrogen sulphide under pressure, filter while hot, and wash the flask and precipitate once with hot hydrogen sulphide water containing ammonium acetate and a few drops of acetic acid. Wrap the paper and precipitate into a dry filter, place it in a porcelain crucible, and dry and roast with the usual precautions. Add 5 c.c. of ammonia to the filtrate from the cobalt-nickel sulphides, evaporate to about two-thirds of the original volume, acidify with acetic acid, and boil for a few minutes. Filter off any precipitate which may form, and ignite it with the main bulk of the cobalt and nickel.

Transfer the ignited precipitate to the original flask, add 10 c.c. of conc. hydrochloric acid, 1 c.c. of conc. nitric acid, and warm gently until the ignited precipitate and any film of sulphides adhering to the flask are in solution. Evaporate to fumes with 5 c.c. of conc. sulphuric acid, cool, take up with 60 c.c. of water, and neutralize the cold solution exactly with ammonia, using four drops of methyl orange solution as indicator. When a neutral solution has been obtained, add from a burette, 1 c.c. of normal sulphuric acid, and dilute exactly to 100 c.c. The color change of the methyl orange can be readily observed with a little practice, although the solution is colored by the cobalt. Saturate the cold solution with hydrogen sulphide under pressure, and allow the stoppered flask to stand for an hour with frequent shaking. Filter the zinc sulphide, and wash with hydrogen sulphide water which contains in 100 c.c. 2g. of ammonoium sulphate and 1 c.c. of normal sulphuric acid.

Add 5 c.c. of conc. sulphuric acid to the solution, evaporate to fumes, cool, add 50 c.c. of water, and heat until all soluble salts are dissolved. Neutralize the cool solution with ammonia (d. 0.90) and add 40 c.c. in excess. Electrolyse in a volume of 100 to 120 c.c. for four to six hours, using a current density of 0.5 to 0.8 ampere per dm^2., or electrolyze overnight with a current density of 0.2 to 0.3 ampere. The deposition of the metals may be considered complete when the addition of a few drops of a solution of potassium thiocarbonate to 1 c.c. of the electrolyte fails to produce a distinct change in color. Wash the cathode with water, then with alcohol, dry at 100°C. and weigh.

Dissolve the cobalt and nickel on the cathode with 30 c.c. of (1:3) nitric acid, and boil the solution to expel nitrous fumes. Then dilute the solution to 75 to 200 c.c., depending upon the quantity and the proportion of the combined metals present, add ammonia until distinctly ammoniacal, then acidify faintly with acetic acid. To the hot solution, add sufficient (1%) alcoholic solution of dimethylglyoxime to re-act with both nickel and cobalt, then add 10 c.c. of a (10%) solution of ammonium acetate, and allow to digest for thirty minutes to two hours. Filter through a tared Gooch crucible, wash with hot water, dry at 130 to 140°C. and weigh.

Calculate nickel and subtract from the total nickel and cobalt, finding cobalt by difference.

While the method is primarily intended for the analysis of ores from Cobalt, Ont., and the surrounding district, it can be readily adapted to meet other requirements. Although the description of the method is somewhat long, the actual operations can be carried out with a reasonable consumption of time by proceeding in a systematic manner.

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THE CANADIAN GOVERNMENT'S CONVERSION SCHEME

The attention of the holders of the five and a half per cent. war loan bonds maturing, December 1, 1922, is directed to the offer of the Minister of Finance to renew the loan on favorable terms. The last Canadian loan was placed in New York at a satisfactory price. The Minister is making his present financial operation entirely a domestic one by offering to exchange the maturing bonds for new bonds bearing the same rate of interest, running for either five years or ten years as the bondholder may prefer. A further inducement to the investor is that he receives a bonus of one month's interest. The terms offered are decidedly favorable to the investor, and it is probable that a large part of the maturing loan will be renewed. Arrangements for the exchange of the bonds can be made at any branch of the chartered banks. Holders who do not wish to re-invest will be paid in cash on the 1st December.

American Dyes Institute.—The American Dyes Institute has been dissolved and its functions will be carried on in future by the Synthetic Organic Chemical Manufacturers' Association.

THE BITUMINOUS SANDS OF ALBERTA

The Second Annual Report of the Research Council of Alberta contains a review of the research work done on the above natural product. Mr. R. A. Clark gives the following general description of the characteristics of the deposit, and the general conclusions arrived at regarding commercial uses.

The bituminous sand, as the name implies, is composed of a mixture of sand the bitumen. The mineral constituent consists of a fine quartz sand, and a very fine silt. The bitumen is present in the form of a layer enveloping each mineral particle. It is a dark brown to black, very viscous, sticky liquid. The bituminous sand as a whole is brownish to black in appearance. The fresh material is fairly soft; it can be molded by the pressure of the hand. It has a decided asphaltic odor. Good samples of bituminous sand contain from fifteen to eighteen per cent. by weight of bitumen.

The bituminous sand occurs in a deposit underlying thousands of square miles of the northern part of Alberta. The bituminized area to which attention is most directed centres about McMurray, at the junction of the Clearwater and Athabaska Rivers. The area is now easily reached by a journey of about 300 miles over the Alberta and Great Waterways Railway, north and somewhat east from Edmonton. The bituminous bed lies on a floor of limestone. It has a thickness, at McMurray, of about one hundred and fifty feet. It is covered by an overburden varying from a few feet to two hundred feet in thickness. The nature of the overburden varies from unconsolidated material to a solid shale and sandstone formation.

Only a small portion of the bituminous sand deposit has any immediate practical significance. The excessive overburden of the greater part of the area underlain by the material makes the deposit inaccessible. The Athabaska River and some of its tributaries, however, have penetrated the overlying strata of sandstone and shale as well as the bituminous bed, and have exposed the bituminous sand in prominent cliffs along the valleys. Some low-lying areas have also been formed where the bituminous sand may be reached under a moderate overburden. The existence of the bituminized bed is revealed by these valley exposures. Our knowledge of the material is derived from an examination of the outcrops. What variations there may be in the nature of the bituminous sand if one could trace it back from the outcrops into the main body of the deposits are yet unknown. Discovery of such variations may have an important bearing on development methods of the future. For the present, however, it seems altogether probable that excavation of the deposit must be confined to the valleys where the bituminous sand can be fairly easily reached.

Separation Processes

We have noted that the bituminous sand contains bitumen as a natural constituent. This fact sharply differentiates the bituminous sand from the oil shales. Oil shales must be given severe heat treatment in some form of retort in order to produce bitumen from them; while the bituminous sand yields bitumen by applying to it any procedure which is capable of separating a mechanical mixture of sand and bitumen. The bitumen of the bituminous sand is asphaltic. It resembles closely the residue left after the distillation products have been removed from an asphaltic petroleum. It also resembles the well-known native asphalts. The bituminous sand occurs in an unsettled region of northern Alberta, three hundred miles from the nearest centre of population. An adequate scheme of development must give these facts proper consideration.

Two obvious requirements must be satisfied by any plan of exploitation which is to be regarded as promising success: it must provide for an economical separation of the bituminous sand at the deposit into bitumen and sand; and it must look toward the utilization of the separated bitumen in the ways to which the present state of technical knowledge indicates that it is by nature adaptable. The bituminous sand deposit lies three hundred miles from the nearest centre of population. Five-sixths of its weight consist of worthless sand. Freight rates will soon outbalance any value the bituminous sand may have as a crude material. The separated bitumen, however, should possess a value which will withstand the cost of transportation. The bitumen of the bituminous sand is an asphalt. The commercial outlet for it will consequently be for purposes for which the world's output of asphalts is used. Any scheme of separation of the bituminous sands which will result in an alteration of the nature of the contained bitumen so that it will no longer be a good asphalt will most likely find itself so entangled in additional problems that it will have small chance of emerging with success.

Separation of the bituminous sand by the use of a solvent for the bitumen seems an obvious means of solving the problem. A commercial application of the method, however, presents serious difficulties and disadvantages. It is not easy to find a cheap, yet satisfactory solvent. The prevention of solvent losses as well as the recovery of the solvent from the solution containing the bitumen also introduce expensive complications. The method appears to belong to the category of processes which are theoretically sound, but which are difficult to put into successful practice.

Separation of the bituminous sand by destructive distillation is the plan which seems to be receiving the greatest amount of attention. The reason for the popularity of this method is not entirely apparent. It is true that destructive distillation is a quite old and well-known process. It has been applied for many years in the treatment of coals to produce coke, tar and gas. It is also the method employed to produce bitumen from the oil shales. There is, however, no similarity between the bituminous sand and coals or oil shales which would indicate that the same type of procedure should be followed in the exploitation of these classes of materials. The bituminous sand is a mechanical mixture of an asphalt and mineral matter. No industrial process for the preparation of an asphalt for economic use submits the asphalt to destructive distillation. Such treatment spoils it for all purposes for which asphalt is considered to be useful. The destructive distillation of the bituminous sand does accomplish the production of a supply of bitumen free of mineral matter. But whether the bitumen so obtained can be commercially utilized is open to question.

The favor enjoyed by the scheme of destructive distillation of the bituminous sand is probably due mostly to the fact that the procedure leads to the production of gasoline, burning oils and lubricants. The manufacture of these commodities from petroleum is one of the most lucrative businesses in which the industrial world has engaged. Any procedure which will produce these valuable products from the bituminous sands would consequently appear to be well directed. If this is true, one naturally wonders why other asphalts, free from association with sand, have not been utilized in the manufacture of gasoline and the other related products. Unsolved difficulties obstruct the way. The production of the common petroleum products from asphaltic bitumens is still in the realm of experimentation.

Petroleum is a natural source of such products as gasoline, illuminating oils and lubricants. These products are directly obtained by distilling the petroleum and fractionally condensing the petroleum vapors. No profound chemical changes are involved. One can gain a fairly accurate conception of the process if he considers that the crude petroleum is a mixture of gasoline, kerosene, lubricating oils, etc., and that the distillation process simply separates the petroleum into these component parts. Purification of the products is accomplished simply and without too serious refinement loss by treatment with sulphuric acid. The petroleum lends itself naturally to the manufacture of the products in question.

An asphaltic bitumen, such as the bitumen present in the bituminous sand, is not a natural source of gasoline, illuminating oils and lubricants. It has already been shown that such a bitumen resembles what is left of an asphaltic petroleum when all these products have been removed. How, then, can it be expected to be a source from which to obtain them?

When the bituminous sand is destructively distilled, a profound change is wrought in the chemical nature of the bitumen. A variety of products is formed: a portion of the bitumen is reduced to coke; another portion is converted to gas; while the balance is vaporized and may be condensed to an oil, differing radically in nature from the original tume. The part of the bitumen converted to coke remains with the sand and is entirely lost. The gas which is formed can be burned to supply part of the heat needed for firing the retort. The oil distillate, only, remains available for manufacture into saleable products.

The crude oil distillate from the destructive distillation of the bituminous sand is comparable to crude petroleum. It also, may be regarded as a mixture of gasoline, kerosene, lubricating oils, etc. It may be separated into these products by distillation, leaving behind a quantity of pitchy residue. These products, also, can be refined by treatment with sulphuric acid. But at this point there enters an unfortunate difference. The products obtained from petroleums can be refined without sustaining excessive refinery losses; whilst the products from the destructive distillation of bituminous sand lose about one-third of their volume in the sulphuric acid treatment. It must also be said that the gasoline and oils finally obtained are not equal, at least in the matter of color and odor, to the similar oils produced from petroleums.

Conclusion

Progress toward the development of the bituminous sand is still held up by a lack of a satisfactory separation process. A process is required which will liberate the bitumen from the associated sand cheaply and without altering its chemical nature. The most immediate economic application of the Alberta bitumen is as an asphalt. Asphalts are chiefly used in road construction; and one of the great needs of Alberta and the other prairie provinces is roads. The development of a type of bituminized earth road which would adequately meet the requirements of our rural highway traffic would at once open up a large outlet for the asphaltic bitumen contained in the bituminous sand. On the other hand, it is not improbable that the decreasing world supply of petroleum will eventually force industry to turn to such sources of bitumen as the bituminous sands for the manufacture of oils. Scientific research may any day discover really efficient methods of converting asphaltic bitumens into gasoline, kerosene and lubricants. Patents are being granted for processes which claim to have accomplished this result. The bituminous sand bitumen may even prove to be a source from which to prepare more valuable commodities than either asphalts or the refined mineral oils. But, whatever the future may disclose about ways of utilizing the bitumen, the first step in the process of development will be the operation of separating the bituminous sand in a way which does not commit the further treatment of the bitumen to the manufacture of one type of commodity, but which leaves the way open to its utilization for whatever purpose it is needed.

GAS CANNOT REPLACE COAL FOR INDUSTRIAL PURPOSES

Numerous applications have been received by Lieut.-Col. R. B. Harkness, Natural Gas Commissioner for Ontario, from localities supplied by natural gas, for permits to use natural gas as a substitute for coal for industrial purposes, on the ground that coal is unobtainable and that its present price is prohibitive. The Commissioner points out that as the supply of natural gas in Ontario is very limited it will be impossible to grant such permits as are requested. The remaining supply of natural gas in Ontario will probably last only a few years longer, and the present policy of the government is to conserve the supply strictly for domestic purposes.

A New Source of Soapstone in Ontario

H. S. SPENCE, M.E.

WHAT shows promise of proving an important and valuable source of soapstone has lately been investigated by the Mines Branch of the Department of Mines, Ottawa. Mr. H. S. Spence, who is at present engaged in preparing a report on the talc and soapstone resources of Canada, for publication by the Mines Branch, examined the deposit in question last October. Mr. Spence's report reads, in part, as follows:—

An interesting and extensive deposit of so-called soapstone occurs one mile west of Wabigoon Station, on the main line of the Canadian Pacific Railway, near Dryden, Ontario. The occurrence is close to Wabigoon Lake, in the township of Zealand, and is distant only 500 yards from the railroad. It is well situated for working, the outcrops being on the top of a low ridge, thus affording good drainage for quarry operations. The mining location is numbered HW133, and the deposit is owned by Mr. E. Pidgeon, Wabigoon, Ontario.

Outside of a small amount of stripping, no development work has as yet been conducted on the property. There is very little overburden, however, and the outcrops are sufficient to show the existence of a large body of soapstone.

The stone may be termed soapstone; though, beyond being soft enough to be cut readily with an ordinary saw, it possesses few of the outward characteristics of what is usually classed as soapstone. It yields a greenish-grey powder that possesses little slip, and the stone is not greasy to the touch, as is talc.

Tests of Stone.

The following tests of samples of stone from the northern band were conducted in the Mines Branch laboratory.

CRUSHING STRENGTH.—Three tests of crushing strength, made on 2" cubes, showed:—

(1) 12,140 pounds per sq. in.
(2) 10,269 " "
(3) 10,755 " "

TRANSVERSE STRENGTH.—Two tests were made to determine the transverse strength. The test pieces measured one inch in thickness by two inches wide; the supports were four inches apart. The modulus of rupture was determined as:—

(1) 1,827 pounds per sq. in.
(2) 1,920 " "

CORROSION.—A sample of the stone, exposed to ordinary room temperature for three months, was weighed and then dried for two weeks at 105°C. On re-weighing, there was no loss in weight, indicating no absorbed moisture. The sample was then immersed in concentrated hydrochloric acid and boiled for 48 hours. After thorough washing, by boiling in water for several days, the sample was dried at 105°C. and weighed. The loss in weight was found to be 9.74 per cent. On immersion in the acid, slight effervescence was noticed, indicating the presence of a carbonate. The sample after treatment showed only slight local pitting. A sample of the alberene stone, subjected to the same treatment, effervesced violently when placed in the acid, and afterwards exhibited extensive pitting; the loss of weight in this case was 17.95 per cent., or almost twice that of the Wabigoon stone. Analysis, also, shows the presence in the alberene stone of almost twice as much carbon dioxide as in the Wabigoon stone.

ABSORPTION.—A sample of the stone was dried at 70°C. for 24 hours, weighed and immersed in cold, distilled water for three days. After air-drying for a short time, the sample was weighed and was found to have gained only 0.12 per cent.

FUSION TEMPERATURE.—Two samples were treated for their fusion temperature, which was determined in both cases as 1,400°C. A sample of alberene stone, tested at the same time, went down at 1,350°C.

It should be noted that all of the above tests and analyses of the Wabigoon stone were conducted on material taken from within a few inches of the surface of the deposit. This material, as shown by the broken test pieces, is traversed by numerous flaws and cracks showing rusty surfaces, and is likely to be considerably inferior in all respects to fresh, unweathered stone.

The stone is very similar in appearance and in composition (as shown by analysis) to the so-called "alberene stone," that is quarried on a large scale in Nelson and Albermarle counties, Virginia, and which is commonly classed as a soapstone. Alberene stone finds extensive employment in slab form for switchboard panels, laboratory table tops and laboratory equipment generally, laundry tubs, etc.; in the form of bricks, blocks and plates, it is used for lining furnaces, and for griddles, fireless cooker stones, foot warmers, etc.

The Wabigoon stone is a dark, greenish-grey rock, composed largely of talc, with some chlorite and dolomite. It is soft enough to be scratched with the nail. The rock is fine to medium-grained, the largest constituents being dolomite crystals that occur as phenocrysts up to ⅛" diameter. There is no approach to schistose structure, the grain being quite uniform and the rock massive and homogeneous in every respect.

Analyses.

The following analyses were made in the Mines Branch laboratory of the stone composing the northern band, and of the 18 inch band of soft soapstone bordering it. An analysis of a sample of Virginia alberene stone is shown for comparison. The analyses show that the Wabigoon contains considerably less carbonates than the alberene stone.

	1.	2.	3.
Silica	41.94	51.44	37.10
Ferrous oxide	7.71	7.24	6.58
Ferric oxide	2.05	3.68	4.57
Alumina	7.57	4.79	4.53
Lime	3.42	None	4.20
Magnesia	25.39	26.43	27.37
Carbon dioxide	5.09	0.11	10.45
Water above 105°C.	6.71	6.56	5.46
Total	99.88	100.25	100.26

1. Wabigoon stone, representative material of northern band.
2. Wabigoon stone, 18 inch band of soapstone bordering northern band.
3. Virginia alberene stone.

Description of Deposit.

Two well defined bands of soapstone occur, separated by about 100 feet of hard grit rock, the nature of which has not been determined. The trend of the band is NW, and the apparent dip is approximately vertical. The stone is well exposed on the summit and west slope of a low ridge that crosses a small peninsula extending from the north shore of Wabigoo Lake. The northern band has a proved length of over 500 feet, with a width of 35 feet. The extent of the southern hand has not been determined, but from the visible outcrops, it is probably considerably the larger of the two bodies. There is very little overburden on the deposit and only a light stand of second growth timber.

The northern band has been stripped for a short distance of the light cover of soil that lies against its southern contact, but no openings have been made upon it. No work whatever has been done on the southern band. The northern band consists of about 35 feet of medium-grained stone, bordered along each contact by 18 inches of fine-grained, compact, soft soapstone. This soapstone is of good quality, is much more greasy to the touch than the stone of the main body and consists largely of talc. Its occurrence is confined to the narrow bands along the contacts, and there is accordingly relatively little of it.

Small veinlets and pocketty aggregates of green, foliated talc occur locally in the mass of the main soapstone bands, but such material would not appear to be present in any quantity.

Possible Uses.

The use that suggests itself most strongly for the stone of this deposit is for bricks for lining the smelting furnaces of sulphate pulp (kraft) mills. These furnaces require a refractory material that is structurally strong and that does not spall or crack under the heat to which it is subjected. There are more than a dozen sulphate pulp mills in Canada, and the aggregate amount of soapstone bricks used is considerable. All of these bricks are imported from the United States. If the Wabigoon stone proves suitable under actual working conditions for the above purpose, the cost of soapstone to domestic pulp mills should be materially lessened.

A further suggested use for this stone is for bake oven bricks. Soapstone bricks are superior to ordinary fire brick for bake ovens on account of their greater heat retention, but their use is limited owing to the difficulty of procuring soapstone and its high cost. It can also be used for laboratory furniture.

Wabigoon stone might also be suitable for fireless cooker stones, foot warmers, griddles, etc.

Conclusions.

This deposit is the most promising, from an economic standpoint, of any of the soapstone occurrences seen in Canada. There is undoubtedly a large tonnage of stone available; the deposit lies within a few hundred yards of the railroad; and the location could not be bettered for a quarry site.

BRITISH COLUMBIA INDUSTRIAL NOTES

The Pacific Starch Company has been incorporated for the purpose of manufacturing starch from cull potatoes at New Westminster. A building has been started on the Fraser river, and it will have a capacity of thirty tons of potatoes per day, and the industry will give employment to twenty-five to thirty people.

Stonite Products, Ltd., which has been making a variety of articles of imitation stone, has been experimenting on a block building stone, and has produced an ornamental article that is capable of bearing a crushing pressure of 1,900 lbs. per square inch. The Company will commence to manufacture these bricks, which will be known as "stonite bricks," and will start branch factories in industrial centres throughout the Province.

EXHIBITION OF FINE CHEMICALS AT LONDON

An Exhibition of Fine Chemicals, manufactured by members of the Association of British Chemical Manufacturers, 166 Piccadilly, London, W., was held at Caxton House, Westminster. The exhibition was specially designed to illustrate, by actual examples, the application, both in general and in particular, of the Fine Chemical Industry to the needs of the State. More than two thousand fine chemicals are now manufactured in Great Britain, and of this number, the most interesting and vital types were represented.

In the case of drugs, the fine chemical relationship is threefold, for drugs of which fine chemicals are the basic agents are vitally concomitant with tropical medicine, surgery, and general medicine and public health. Tropical medicine offers a vast field for British chemical research, and a direct instance of the practical and beneficial results won by such research was supplied by an exhibit of chaulmoogra oil, now being used with considerable success in the treatment of leprosy and consumption, both in England and abroad. The exhibits in this class included a number of newly discovered drugs and injections for use in fighting and overcoming the terrible diseases rampant in many tropical and sub-tropical countries, such as blackwater fever, sleeping sickness, malaria, hookworm, dysentery, kala-azar, yaws, undulant fever, and cholera.

The fine chemical therapeutic agents used in surgery are mainly antiseptics, local anæsthetics, and cocaine substitutes, such as eucaine; general medicine and public health are indebted to the fine chemical industry and wholly dependent upon it for astringents for burns and wounds, and sedatives for hysteria and for sea-sickness, such as menthyl valerate. The fine chemical injections such as contramine are now also being used with success against venereal disease.

Stainless cutlery is a popular example of the value of fine chemicals in general industry. The rare earths, such as tungsten, vanadium, and molybdenum, which form the basis of the gas mantle, hardened tool, armor and motorcar axle exhibits, are obtainable from their ores only by the application of fine chemicals. The white and colored powders known as catalytic agents are the chemical "wonder points," which by their mere presence bring about the chemical change which is essential to the manufacture of nitrates and ammonia from the air.

The years following the war have seen a phenomenal increase in Great Britain's output of photographic materials, although in 1914 this country was dependent on Germany for a great many fine chemical materials, to-day, metol developer—which is essential to all X-ray surgical work—amidol, silver nitrate, &c., are produced by British manufacturers in the requisite quantities and at prices which favor the consumer. The Shackleton expedition is completely furnished with photographic chemicals from British laboratories.

A typical instance of the close application of the fine chemical industry to everyday life was provided by the flavorings and perfumes exhibits. Anisic Aldehyde is a synthetic perfume with a strong heliotrope odor; the by-product of this perfume is the cheapest and most efficient tanning liquor obtainable. A parallel example is Salicylic Acid—used in the preparation of dentifrice, embrocation, aspirin, dye, and preservatives for strawberry jam. Yet a third example is Vanillin, an important synthetic fine chemical by-product of the gas industry, which is used in the preparation of biscuits, confectionery, and chocolates. Saccharine, too, is a fine chemical product of the first importance, especially in war.

A great proportion of the chemicals exhibited were not manufactured in Great Britain before the war. The British Fine Chemical Industry is now, however, well established, and there is every prospect that after a few years it will be in a position successfully to combat foreign competition.

New Books

"THE PROPERTIES OF ELECTRICALLY CONDUCTED SYSTEMS"

By Charles A. Kraus. Chemical Catalog Co., New York. 415 pp. Price $4.50.

The whole subject is treated broadly, both aqueous and non-aqueous solutions being fully dealt with. The author first deals with conductors and the theory of the conduction process in electrolytes. The form of the conductance function is discussed, and the various factors, viscosity, temperature, mixed solvents, etc., which play a part, are taken up. There is a chapter on carriers in electrolytic solutions. The question of equilibria in mixtures of electrolytes is treated at some length, as well as great variety of influences, such as diffusion, optical properties, reaction velocities.

Having developed the experimental phenomena of all types and cases, the general theories advanced so far are well discussed and set out in balanced, complete form.

The latter portion of the book is devoted to cases intermediate between metallic and electrolytic conductors, pure substance, fused salts and the general properties of conductance in metallic substances.

We venture to think that the author, while making no claim to having said the last word or having reviewed all the work done, has completed his task in a most desirable manner. He has placed in one book a very excellent account of our knowledge to date on the subject and the really interested reader may well be stimulated along new lines of work and thought.

"CALCULATIONS OF QUANTITATIVE CHEMICAL ANALYSIS"

By L. F. Hamilton and S. G. Simpson. McGraw-Hill Book Co., New York. 183 pp. Price $2.00.

This little book might be called a chemical arithmetic. It points out the meaning of "Significant Figures" in chemical calculations, and we trust will result in cutting off several decimal places from the reports of some analysts. As a textbook for classes, it offers very sensible problems and could be used regularly in any laboratory.

"PETROLEUM: WHERE AND HOW TO FIND IT"

By Anthony Blum. Modern Mining Books Publishing Co., Chicago. Price $2.00.

A very straightforward account of the practical work of searching and drilling for oil. The technical part of the book appears well suited for men in the field. The chapters on fiscal features should save many investors, if such literature ever came to their attention.

NEW MEMBERS, CANADIAN INSTITUTE OF CHEMISTRY

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The New Jersey Zinc Co. reports for the quarter ended June 30, total income of $1,637,161 after ordinary taxes, maintenance of equipment and plant and depreciation. This compares with total income of $637,440 last year, and with $3,341,577 in 1920. Net income, after interest and special reserves, was $1,586,645 against $583,927 last year, and $2,756,577 in 1920.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy.)

Real Effort to Establish Iron and Steel Industry on Coast

Considerable interest has been aroused in the Coast cities by another attempt to establish an iron and steel industry. There is no doubt, of course, as to the necessity for such an industry. At the present time, every iron and steel article, from a carpet tack to a bridge girder, either has to be brought over the Rockies from eastern Canada or to be imported from Europe or the United States, and the freight charges add immensely to the cost of the materials. It has been fairly well demonstrated, too, that there is sufficient ore available to start an industry, while there are promising prospects that give every indication that they are likely to be developed into large iron ore mines. We have ample coal suitable for the manufacture of good metallurgical coke, so that conditions are favorable for the initiation of an iron and steel industry. Within the last few years, many attempts have been made to start such an industry, but for some reason or other they have fallen through.

The present effort is being made by H. J. Landahl, who has organized the Coast Range Steel Company, and who claims to have behind him the well-known British firms of Vickers, Ltd.; Simon Carves, Ltd., and the Wellman Smith Owen Engineering Corporation. Moreover, Mr. Landahl asserts that he has practically made arrangements with the British Government, through the Imperial Trade Facilities Committee, and the Dominion Government for each to guarantee one-third of the company's debenture issue of $12,000,000, and he made application to the Provincial Government to do the same. The Cabinet held a meeting to consider the proposal, after which the Hon. John Oliver announced: "That the Government would promote legislation authorizing a guarantee of the company's bonds to the extent of one-third of the amount required to establish an iron smelting plant for the production of pig iron in British Columbia. This guarantee would be conditioned upon each of the Dominion Government and the Imperial Trades Facilities Committee, guaranteeing the other two-thirds of the capital required." The Premier announced further that the Government would promote legislation to make the iron ore bodies of the Province available for use on a royalty basis; and that the Minister of Mines ahd been authorized to confer with the Dominion Government and the Imperial Trades Facilities Committee with a view to employing such experts as would be found necessary to investigate thoroughly every detail of the proposal.

The Company is to have an initial bond issue of $12,000,000 and a common stock issue of $15,000,000, divided into 150,000 shares of $100 each. The whole of the common stock, with the exception of eight shares that have been subscribed for by the original promoters, is to go to Mr. Lanhahl in consideration for a number of mining properties and options on properties and prospects in different parts of the Province. This appears to your correspondent to be the flaw in the scheme, as sufficient development has not been done on their iron ore deposits to prove them to be worth anything like that amount of money. As already has been reported in these columns, the Provincial department of mines is at the present time collaborating with the Geological Survey in an investigation of the iron ore resources of British Columbia, and this work is likely to bring to light some exceedingly valuable information. In the past, however, owing to the fact that there has been little or no demand for iron ore, only a comparatively small amount of development work has been done on our iron ores, consequently the amount of ore actually proven has been small.

High Grade Ore Located at Big Missouri

Good news continues to come from the Northwest section o the Province. A. B. Trites—phenomenal luck seems to follow him. He was one of the syndicate that bonded the Premier Mine and brought it to the producing stage, after Col. W. B. Thompson had spent $60,000 in futile search, and now he and his associates have found a fourteen-foot shoot of high-grade ore at the Big Missouri, four miles north of the Premier Mine. The ore-shoot has been traced for 200 feet on the surface, and is said to be high-grade, shipping ore. Sir Donald Mann and associates had the Big Missouri under bond for some time and spent a considerable amount of money on exploration without finding sufficient ore to warrant their buying the property.

Development in the North

The American Mining & Milling Company has bought a controlling interest in the Fish Creek Mining Company, which is operating a property on the Alaskan side of the boundary. Freibergite running up to 2,000 ounces in silver has been found recently on this property, and a ten-ton shipment is being made up. Several shipments have been made from the Fish Creek mine, and more will be made as soon as the road to the mine is completed.

Notes

Boyle Brothers, diamond drill contractors of Vancouver, have commenced work on a contract for the British Columbia Silver Mines, Ltd., whose property adjoins the Premier Mine. The Premier company owns one-third of the stock of the company, the remaining two-thirds being owned in London. The B.C. company has recently acquired Cascade Falls No. 5 claim, at a price, it is said, of more than $50,000.

H. C. Magee is developing two promising belts of ore at the Patricia group, on the south fork of Marmot river. The smaller belt, which is twelve feet wide, is said to give an average of $55 per ton in silver and lead. Mr. Magee has been developing this property for the last two years.

An Anyox syndicate has purchased the Esperanza mine, near Alice Arm, for $35,000. The Esperanza has been shipping ore running about $40 per ton to Anyox for some time. Recently two new ore-shoots were discovered in a tunnel above the main workings.

Mining conditions in the Kootenays have greatly improved since the Consolidated Mining & Smelting Company introduced its new zinc schedule. Silversmith Mines, Ltd., disbursed a dividend of $25,000 for the three months ended June 30. This is the first dividend that the company has paid since December, 1920. The mine is in splendid condition, and sufficient ore has been developed to maintain the present rate of production for two or three years, while the limits of the ore-shoot have not yet been ascertained. The company is producing silver-lead and silver-zinc concentrates.

Florence Silver Mining Company has re-started its 300-ton mill, at Ainsworth, and is developing some splendid bodies of ore, which, though low in silver, contain from twelve to twenty per cent. of lead.

Standard Silver-Lead Mining Company, which sold the old Standard mine, at Silverton, last year, after having disbursed $2,700,000 in dividends as the result of its operations, has bonded the Ivy Fern mine, at Cultrus creek, and has taken an option of a controlling block of shares in the Slocan Silver Mines, Ltd., which owns the McAllister mine, at Carpenter creek. The Standard company, which has $400,000 in the treasury awaiting investment, is doing a considerable amount of exploration work at both of these properties.

Forest fires, which have been raging throughout the Province, have destroyed all the surface buildings at the Gibson, the Silver Bell, and the Silver Bear mines, at Kaslo creek, and Silver Cup and Big Tunnel mines, near Ferguson. The Gibson mine was sold by the sheriff on the day of the fire for $76,000, the unfortunate purchaser not hearing of the fire until after the deal had been consummated.

NORTHERN ONTARIO NOTES

The Hollinger Consolidated Gold Mines, Ltd., have completed arrangements with the Ontario Government in the matter of securing a full power supply, and the company is proceeding to develop power sufficient to its needs. This development is expected to be completed within a year and will enable Hollinger to double its output. Since production at Hollinger in 1921 was valued at $10,031,050, a doubling in production would make Hollinger the world's greatest gold producer. The rate of profits earned at Hollinger for the first six months of 1922 is not quite as high as for the last six months of 1921, due to the decline in value of ore treated, which was not fully compensated for by a corresponding decrease in costs.

The figures for the first six months, 1922, can best be contrasted with the preceding period, for which figures are available, that from July 30 to December 31, 1921, twenty-two weeks:

1922—Twenty-six weeks, January 1 to June 30.

Tons of ore milled	665,115
Average tonnage per day	3,950
Net value recovered	$5,669,556
Total net profits	3,034,966
Average weekly profit	116,730
Average value per ton	8.82
Average cost per ton	4.42
Average profit per ton	4.40

1921—Twenty-two weeks, July 29 to December 31:

Tons of ore milled	567,233
Average tonnage per day	3,659
Net value recovered	$5,188,464
Total net profits	2,751,738
Average weekly profit	125,080
Average value per ton	9.14
Average cost per ton	4.29
Average profit per ton	4.85

Recently costs per ton have been considerably reduced below the half-year average, being brought to below $4, and running as low as $3.85 per ton. In the last week of the half-year a profit of $141,000 was won. In June the average tonnage was $4,281 tons, and the yield $1,020,000, from a total of 119,855. In August, mill crushings have been running 4,500 tons daily. There is reason to expect that it will be brought to 5,000 tons before the close of the year. With earnings running 24 per cent. of issued capital, and dividends disbursed at the rate of only thirteen per cent annually, the Hollinger cash surplus has mounted. It is now nearly $7,500,000, although payments on Schumacher will tend to hold it down.

Hollinger's gross income from start of milling to June 30, 1922, totals $56,041,034; net profits, $28,738,559, and dividends, $18,268,000.

Large Production at Teck-Hughes

On August 19th, the Teck-Hughes Gold Mines shipped over $35,000 in gold, representing the production at the property for the first two weeks in August. In July, over $70,000 was shipped and the August output is expected to equal that of July.

Pulp and Paper Specialist, Forest Products Laboratories, Montreal

INITIAL SALARY $3,120 PER ANNUM

Qualifications: Education equivalent to graduation in science from a university of recognized standing, preferably with specialization in chemistry or chemical engineering; at least four years' experience, after graduation, in research work relating to pulp and paper or in the manufacture of pulp and paper; wide knowledge of the technology of pulp and paper and of their industrial utilization; some knowledge of office practice; executive ability.

Applications will be received by the Civil Service Commission, Ottawa, until October 3rd, 1922.

World Conditions and News in Chemical Fields

(Special Correspondence to Canadian Chemistry and and Metallurgy by Our London Representative)

British Chemical and Dye Markets

The Board of Trade returns indicate a decided improvement in exports of drugs, chemicals, dyes, and colors, the total amounting to £1,785,111, an increase of £786,546 compared with June last year; of the above amount, £204,024 represented drugs, medicines, and medicinal preparations, or £54,890 more than a year ago.

Buyers of chemicals still seem to lack confidence in the future, particularly as to the trend of prices, and although there has been evidence of better inquiries for export, business is still generally confined to small lots.

There has been a considerable falling off in business in aniline dyestuffs. In all branches of the textile trade, the demand for dyestuffs seems to be considerably less, and for smaller quantities. It is, however, confidently hoped that the falling off is only for the moment, and that trade will improve again. In fact, at the present time the indications are that business is coming back somewhat, although the gradual improvement which had been previously reported is certainly not maintained at the moment.

Prices of pharmaceutical products have been fairly well maintained, although one or two slightly easier rates have been quoted, notably for oxalic acid, barbitone, salol, and camphor. Continental competition is less keen than it was, owing partly to the fact that German costs of production have been continually increasing, whilst British costs have been gradually falling.

Iron and Steel Production in Great Britain

Production of pig iron in June amounted to 389,200 tons, a decline of 38,700 compared with May. The number of furnaces in blast at the end of the month numbered 115, compared with 110 at the end of May. The production included 109,700 tons of hematite, 139,200 tons basic, 78,900 foundry, and 18,400 tons forge pig iron. The production of steel ingots and castings also declined in June to 400,200 tons, compared with 462,300 tons in May.

Oil Boring in Scotland

Oil has just been discovered in the Government boring at D'Arcy, near Dalkeith. The oil is from strata situated at a depth of 1,810 feet, and is of a dark, thick character. Boring operations were started over three years ago, after a careful geological survey on behalf of the Government, and experts from the United States have been engaged since then in sinking a bore twenty-two inches in diameter for 150 feet, and six inches for the remaining distance. A first analysis indicates that the specific gravity of the oil is 0.819 at 60° F., and that it contains fifteen per cent. of motor spirit, twenty-five of kerosene, thirty-five of gas oil, and twenty-five of lubricating oil. It has a paraffin base.

Oil Refining in Wales

The refinery established at Skewen, near Swansea, by the National Oil Refineries, Limited, a subsidiary of the Anglo-Persian Oil Company, marks a departure from the usual practice of carrying out the refining operations at or near the point of production, for in this case the crude oil is brought by tank ships from the oilfields in Persia, some six thousand miles away.

Operations for the construction of the refinery were started in February, 1919, with the building of a spur line from the Great Western main line, so that the enterprise has been brought to its present stage in a little more than three years, with an expenditure of some three million sterling. At present, the refinery has a capacity for a throughput of 2,000 tons of crude oil daily, but an increase of 50 per cent. has been decided upon.

At Swansea Harbor, in the Queen's Dock, there are three berths, though one has not yet been brought into use, for the reception of the tank ships. From the jetties six pipe lines, two for taking crude oil from the ships and four for bringing the refined products back to them, lead to an adjacent transit or auxiliary tank site, where there are eight tanks with an aggregate capacity of 80,000 tons for the temporary storage of both crude oil and refined products, the one until it is pumped up to the refinery, some 300 feet higher in elevation and about four miles distant in a direct line, and the others until they are loaded into the ships. The transit site includes a pump house with a battery of centrifugal pumps, driven by 3,300 volt motors supplied with current from the station of Swansea Corporation.

From this point, six welded steel pipe lines, ranging in diameter from eight to twelve inches, run to the main tank farm near the refinery. Two are for crude oil and four for refined products. At this main tank farm there are thirty-three tanks; twenty-five with a capacity of 10,000 tons each are allocated to the storage of crude or fuel oil, four of 5,000 tons each are for kerosene, and four of similar size for petrol. The total storage capacity here exceeds seventy-five million gallons.

The refinery buildings stand on the slope of a hill, which is surmounted by a water storage tank and a tall observation tower. The boiler house and power station are placed near the centre of the site; the former contains six Thompson boilers, to be increased to eight when necessary, and the latter three turbo-alternators of 2,500 kw. each, three-phase, 3,300 volts running at 3,000 r.p.m. The turbines are by Messrs. James Howden and Company, and the alternators by the English Electric Company. The first operation is the distillation of the crude oil for the separation of the lighter fractions which form the basis of petrol and benzine. The stills are on the continuous system, and arrangements are made, by the introduction of heat interchangers, to raise the temperature of the incoming crude oil by heat abstracted from the distillates. In fact all through the refinery careful attention has been paid to the conservation of heat with the object of keeping the fuel consumption at a minimum.

FRANCE

Light-Weight Concrete

In a memoir to the Academie des Sciences Colonel Rabut, Inspecteur-General des Ponts et Chaussees, refers to the experimental researches in which he has been engaged since 1909 on concrete made with slag of considerably lower specific gravity than that of the gravel and broken stone customarily employed. He has established the facts that, other things being equal, slag concrete is generally stronger, though sometimes a little weaker, than gravel concrete; that its weight is from thirty to forty per cent. less than that of gravel concrete; and that the ratio of strength to weight attains maximum value when the proportion of sand is from one-fourth to one-fifth that of the slag used as aggregate. Proceeding to make practical applications of his experimental results, Colonel Rabut has constructed in slag concrete the principal parts of two important works—the bridge carrying the station of Asnieres, on the outskirts of Paris, and the Lestonnat Jetty in the port of Bordeaux. He has recently completed, in the Arsenal of Lorient, a large jetty entirely in slag concrete, including piles 65 feet six inches long by fifteen and three-quarters inches square, and has constructed tank wagons and barges in the same material.

Experience in the United States has demonstrated the possibility of producing concrete of about half the weight of, and equal in strength to, concrete made with ordinary aggregates. While the reduction of useless deadweight is obviously economical in every class of construction, Colonel Rabut shows that it is specially advantageous in certain types of structures. For instance, in suspension bridges the employment of light concrete in the towers and platform is attended by great economy, particularly if the latter embodies stiffening girders, but the permissible length of span cannot be materially increased. In the case of arch bridges, however, a further advantage is obtainable. If the super-imposed load is small relatively to the dead load, the length of span, or alternatively, the bold ness of the arch, may be double that permissible for ordinary concr ete; and even if the arch is to carry heavy railway traffic t he advantage secured is fully thirty per cent.

INDUSTRIAL DEVELOPMENTS

ST. JOHN'S, NEWFOUNDLAND—Three-quarters of a million tons of ore are to be delivered to Rotterdam from Wabana for trans-shipment via canals into Germany. Twelve steamers of 11,000 tons of ore a month are to sail to Rotterdam between now and December. Overseas shipments of iron ore from Wabana have been practically nil since 1911. The new contracts with German agencies will bring about a revival of pre-war prosperity in the Wabana district.

MONTREAL, QUE.—The consolidation recently of the manufacturing and distributing resources of the Dominion Oxygen Co., Ltd., and the National Electro Products, Ltd., gives Canada one of the largest organizations of its kind on the continent. The business is to be conducted under the name of the Dominion Oxygen Co., Ltd., now operating plants at Montreal and Toronto, and acetylene plants at Merritton, Winnipeg and Shawinigan Falls. In addition, the company conducts oxygen and acetylene distributing stations at Hamilton, Windsor and Quebec.

THREE RIVERS, QUE.—The Wayagamack Pulp and Paper Company, and the St. Maurice Lumber Co., of Three Rivers, are loading a steamer with about 1,500 tons of paper, destined for Auckland, New Zealand. Several large orders have recently been received by these companies from buyers in the Orient.

WINDSOR, ONT.—The installation of machinery and equipment for the manufacture of liquid chlorine, at the plant of the Canadian Salt Co. is nearing completion. Production of chlorine is expected to be under way about the middle of September.

THE ELECTROPLAX COMPANY

The Electroplax Company, Toronto, with plant at Mount Dennis, near Toronto, is the direct result of an amalgamation under The Bakelite Corporation, of the General Bakelite Co., The Condensite Co., of America, and the Redmanol Chemical Products Co.

The money invested in the new undertaking is, however, entirely Canadian, and while the Electroplax Company has been assured of the direct supervision of Dr. Redman, now technical director of the Bakelite Corporation and of Mr. Lehman of the Cutler-Hamner Co., whose products, the new Canadian Co. are also making, the firm remains a distinctly Canadian undertaking from a financial standpoint.

The cold moulded products and the various industrial articles now made by all companies in the United States in these fields will be made in Canada as required from basic raw materials.

Dr. Redman stated in a recent interview in Toronto, that the arrangement has allowed the new company all the advantages of nearly a generation in most expensive research and practical manufacture, so that though they have been started but a short while, they are turning out products, the quality of which compares most favorably with those made in the United States. Many of the products are finding uses in the radio field. The officers of the new company are: President and General Manager, H. E. Corey; Vice-President, Dr. L. V. Redman; Manager, W. M. Davidson; Factory Superintendent, Mr. J. B. Rathbun; Chemist, W. A. Campbell.

PRODUCTION OF IRON AND STEEL, CANADA JULY, 1922

Pig Iron and Ferro-Alloys

The production of pig iron in Canada during July presented an increase of 10.2% over the record for June. The output in July was 31,705 tons as compared with a production of 28,763 tons in the previous month. The decided advance in the basic pig manufactured for further use was an interesting development in this connection. In June, 14,714 tons were produced while in the next month, the records indicate an output of 25,419 tons. Notwithstanding the encouraging increase over the totals for May and June, the output in July is considerably below the monthly average for 1921 and for the first half of 1922. The average for the half year was 32,031 and during 1921 the average monthly production was 51,534 tons.

The output in July, 1921, was 54,086 tons and the record for the month under review presents a decrease of 41.4%. The cumulative production for the seven months ending July 31st last was 223,892, as compared with a total production of 363,292 tons during the corresponding period of 1921.

The furnace at Hamilton was idle at the end of the month leaving in operation two furnaces at Sault Ste. Marie and one at Sydney.

The production of pig iron during July in the United States showed an absolute increase of 39,017 tons as contrasted with a loss in the daily rate of 1281 tons. The composite price increased from $24.05 per gross ton on July 25th to $24.38 on August 1st. The Canadian price of basic pig iron as quoted by one of the steel companies remained steady for July at $27.00 per ton, notwithstanding the rapid increase from $24 in April to $27 in June.

Steel Ingots and Castings

A surprising advance in the production of Canadian steel was effected in July. The output in June was 32,805 tons while in the month under review 62,767 tons were produced, constituting an increase of 91%. The advance occurred chiefly in the open hearth basic ingots produced for further use. The output was 61,243 compared with 31,206 tons in June, comprising an increase of 96.1% The average monthly output of the grade during 1921 was 53,489 tons, and the average for the first half year of 1921 was 27,938 tons. The greater part of the increase for July was reported from the steel plant at Sault Ste. Marie.

During the seven months ending with July 31st, the production of steel was 239,847 as compared with a cumulative total of 319,118 tons for the same period last year. The output of open hearth basic ingots in the seven months of the present year is below the production in the corresponding period of last year by 101,095 tons. The steel castings produced in the seven months of last year are also in excess of the production for the corresponding period of this year by 3,918 tons, or 28%.

The splendid increase in steel production during July in spite of coal shortage speaks well for future prospects. Improvements in marketing conditions is the chief factor accounting for the altered outlook. According to reports, the United States Steel Corporation entered the first week of August with a steel output at nearly 70% of capacity and the average for the independent companies was nearer 60%.—From Report of Mining, Metallurgical and Chemical Branch, Dominion Bureau of Statistics, Ottawa.

The Canadian Pipe Company's plant at Vancouver has been completely destroyed by fire. The plant was erected about twelve years ago for the manufacture of wire-bound wooden pipe, continuous stove pipe, and wooden tanks. The fire originated in the asphaltum dipping plant, which is supposed to have been overheated.

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TABLE OF CONTENTS

EDITORIALS:

Page.
Canadian Institute Makes Progress 211
New Phase of Industrial Education 211
Have Canadian Chemists No Class Consciousness.... 212
Joint Research on "Alkali" Waters 212

CORRESPONDENCE:

"Chemor" or Nothing........ 213
Mineral Production in Canada 213
Physical Testing Graphs By W. B. Wiegard 214
Production of Iron and Steel During August 216
Meetng of Maritime Chemists' Association 217
Members of American Ceramic Society Visit Canada.... 219
Montreal Meeting, American Electrochemical Society 220
American Chemical Society's Meetng at Pittsburgh........ 221
Eighth National Exposition of Chemical Industries, Report of 224
Page.
Address of Dr. Herty at National Exposition 224
Chemical Society News 226
Report of Council Meeting, Canadian Institute of Chemistry 226
Obituary—Dr. Henry Larouche 227
New Members of Canadian Institute of Chemistry 227
New Books 227
Annual "School" Reunion 227
Chinese Chemists Organize 227
Mineral Output of Ontario, First Six Months, 1922........ 228
Mining and Metallurgy in British Columbia 231
Industrial Developments 232
Catalogs Received 232
Market Review 232
Buyers' Guide 44
Classified Advertisements 50
Index to Advertisers 52

FROM THE PUBLISHERS—

THOSE WHO GET ON

Among other things, the Chemical Exposition stimulates a considerable amount of discussion among people who would otherwise never meet. A casual caller at the booth of this paper took occasion to classify chemists as "Those who get on, and those who don't." There was nothing very brilliant about this remark, but it was evident that a well-defined idea stood behind it. He himself had no special chemical training, but was the mere manager of a quite large business, one branch of which brought his salesmen in touch with chief chemists.

He could not understand how men whose work was so important and whose judgment could be developed and should be the best in a great many questions, had so little to say in the ordinary business affairs of the companies they represented. Those "who get on," in his opinion, were those who knew that they knew, and were not afraid to say so, even to the President; and those "who did not" were the kind who maintained an excessive silence and were ordered around by the office boy.

Industries are waiting for young chemists to grow up and take hold of them, just as much as they are waiting for anybody else.

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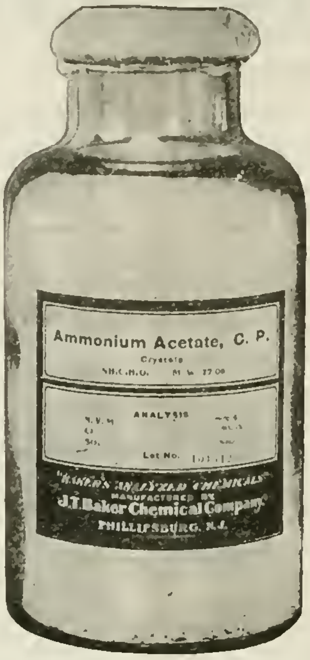

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EDITORIALS

CANADIAN INSTITUTE MAKES PROGRESS

SOME see and interpret small movements; others must be knocked down by them before they will admit their existence. Some see things locally; some can secure a Dominion viewpoint; others will reach an Imperial conception; and a very few live in international atmosphere. Thus may chemists be classified.

The Canadian Institute of Chemistry is increasing its momentum. The number of people actively concerned in pushing the work is increasing, and the special machinery necessary to some local evidence of its existence has been arranged for. Elsewhere we report a most important meeting of the Council of the Institute, and the formation of a Maritime Branch. Those chemists in the Eastern Provinces who so unanimously elected to co-operate with others throughout the Dominion, demonstrated that the East is prepared to join up in professional matters, following the trail of confederation.

The significance of their action cannot be overestimated. It is the expression of a desire to know more personally those who are in common employment with them in Western and Central Canada, and an adoption of the principle of the Dominion unit, as an aim to professional development.

The plans proposed for provincial and local organization seem logical, and will allow for much closer contact on the part of those who so far have not received such benefits through the organization. The proposed changes in By-Laws will broaden out the field, and, we take it, are designed to cover the requirements of a few who may have some general interest in the work of the Institute, or who may desire to support it in a nominal way. It allows the standards of the Institute to be kept at a high level for those who take an active part, but does not exclude from a very considerable measure of activity those who may not possess academic or industrial experience of an order demanded by the regulations for full membership.

What may be entirely missed by some Canadian chemists is the fact that they are building up, through their Institute, an organization which is being received by chemists elsewhere as something of a model. Where we have been trained to look abroad for new ideas, and are, therefore, made followers, rather than leaders by the process, it is refreshing to consider this standpoint. In Canada there is a relatively clear field. Chemists can develop any type of organization which appears to be suitable. They have not, to begin with, quite the same number of powerful, but possibly unsuitable lines of division already established. Our two main chemical organizations make distinct appeals to professional and industrial interests. They should prosper side by side, if logically developed without the use of inflation methods.

The really big thing that is happening in all these developments, is the closer knitting of the personal relationships existing among chemists and a broadening out of the influence they may have as individuals in commercial, professional and public life.

A NEW PHASE OF INDUSTRIAL EDUCATION

THE pulp and paper industry in Canada, and the United States is seizing its technical problems in both hands, and we submit is making a fine job of it. The latest development now just beginning to operate is the broad educational plan, whereby employees may study and develop, while they carry on their daily duties. Canada has suffered some, because of the delay in establishing technical school and specialized industrial colleges.

The pulp and paper industry is taking a lead. A series of text-books, written by men qualified in educational matters, and in the manufacture of paper has been prepared, a staff of examiners has been gathered, practically all of them experts in some phase of paper-making or forestry. Students are being enrolled from the various mills and the whole organization has been worked out on a reasonable cost basis. What this means to the industry in the development of better workers and more skilled and satisfied employees remains to be estimated. It will mean that Canadian mills will produce paper at an increased efficiency. Education may be counted on for that. In every direction, the result of this work will spread out in years to come, when perhaps paper may be only one of five or six main products from wood.

From the educational standpoint, the effort will be watched with interest. There is no reason why subjects of general cultural value may not be introduced. We see no reason why a paper mill worker may not proceed to a degree in arts, taking such practical sciences and engineering as relate to his work for that portion of his education. Perhaps our leading university heads will not admit of this possibility, believing that there is some sacred privilege about the mechanism of university life, but there are forces of a general nature at work, which are more than likely to spread educational activities throughout many new fields; and why not? If men in the far north woods can study and work in correspondence classes, using a real plant as their laboratory, why cannot we extend this to our textile industries, our metallurgical and mining industries and our agricultural industries? Perhaps some government or individual will arise to co-ordinate these movements. Perhaps through such education, cartoons showing labor and capital at war may vanish, and a new conception of what constitutes industrial economy, research and good government be developed.

We have wandered from pulp and paper; but we do congratulate any industry that takes hold of its own affairs in this way and responds to such practical guidance.

HAVE CANADIAN CHEMISTS NO CLASS CONSCIOUSNESS?

IS it possible that such a charge is close to the mark? Are chemists to be described professionally as pigmies, running around the feet of well organized professions and classes.

This is not a remarkable vision to see, when we hold the mirror before us, but there are plain evidences at times that the idea of Canada as a nation, with Canadian chemists as a united profession, assisting a united Canadian chemical industry, is just a little beyond the grasp of most of those who argue and worry about lesser things, or are completely immersed in the sea of inertia.

The reason for this would seem to be that, for the most part, chemists are foolishly organized in nearly all countries, and in Canada are diluted beyond sustained contact. For example, one of the simplest problems that should be settled over night seems to remain a gigantic stumbling block for consulting chemists and analysts. Each states that the charges for analytical and testing work are absurdly low, and yet all are certain that nothing can be done about it. This miserable condition, which breeds inaccuracy and lack of confidence, is allowed to drag along, simply awaiting some co-operation. There would seem to be chemists who would sit with four aces in their hand and not open a jack pot.

There seems to be almost an entire lack of training in our universities designed to guide young graduates along these lines. Undergraduate activities may be sufficient and extremely pleasant, but the young chemist is not taught to take the step from the university to the Dominion professional viewpoint. He steps out into thin air, or the United States, and is often lost to the profession, as far as organization work is concerned. He is cut off with his professional citizenship training about half-completed, unless he happens to be one of those individuals who acts as his own alarm clock.

If there is any profession in the world where contact between younger and older men is required, it is chemistry. Canadian chemistry needs some strong men in every province, who can see where the nation is going industrially, and by their leadership hold together the industrial and academic professional chemists of Canada, in an organization or organizations, which will allow them to think in a businesslike, national way, and act with the national good in view at all times. We are fully advised that some of the framework has been set up, but even this is viewed through a haze by a large number. If Canadian chemists cannot lead other professions, surely they can follow.

JOINT RESEARCH ON "ALKALI" WATERS

THE Governments of the Dominion, Alberta, and Saskatchewan, the Canadian Pacific Railway Company and the Canada Cement Company have subscribed \$13,500 toward an investigation into the action of "alkali" soils and waters on concrete, and a committee under the chairmanship of Professor C. J. Mackenzie, of the University of Saskatchewan, has been appointed to carry out the research. The investigation has been ordered because serious alarm is felt for the safety of a number of structures in the Prairie Provinces, on account of the damage that is supposed to have been done to the foundations by "alkali" waters.

The word "Alkali" as applied to soils and waters is used very loosely in the west, being made to cover the salts of all alkalies and alkaline earths. The nature of these salts varies markedly in different parts of the prairies; sodium sulphate, chloride, and carbonate, and magnesium sulphate, carbonate, and chloride predominating in turn. It would appear, therefore, that unless a physical remedy in the form of some waterproofing material is devised, a different remedy may be needed for different districts.

The action of the alkaline salts on the reinforcing steel, too, will have to be considered. Most alkaline salts found in soils and waters cause steel to corrode, and the corrosion once started, given access of air and moisture, oxidation proceeds rapidly, causing the reinforcing material to swell to two or three times its original size and the force then tends to fissure the concrete in all directions from the reinforcing steel, thus greatly weakening the structure.

DR. REDMAN TO ADDRESS TORONTO SECTION

Dr. L. V. Redman, formerly of the Redmanol Chemical Products Co., now amalgamated with the General Bakelite Corporation, will address Toronto Section, Society of Chemical Industry, Friday evening, October 20th, at Hart House, University of Toronto.

"CHEMOR" OR NOTHING

The Editor,
Canadian Chemistry and Metallurgy.

Dear Sir:

Except to keep the discussion going, the alternatives mentioned in your August editorial were not worth printing. "Ic" is an adjective. Why insert it between the root and the substantive suffix? "Ist" and "or" represent the same idea, viz.: person, agent, "one who." Why use more than one of the two? Probably this form was suggested by a desire to get more of the word "chemistry" into the proposed title. In that case, "chemistror" would have been more to the purpose. But "chemistry" seems to have been derived from "chemist" and the form "chemy" recognized by the dictionaries as a variant of "chemistry." "Chem" represents the science "or" the agent. What need for any more?

No, unless some one has still another suggestion, the choice lies between—(1) adopting "Chemor," (2) robbing the dispenser of one of the numerous designations to which he has well-founded claims, and (3) lingering amongst existent ambiguities.

The New Standard Dictionary, which I understand gives precedence rather to the most general than to the oldest signification of a word, gives "chemist" (1) one who is versed in or practises chemistry. (2) one who makes or deals in chemicals; a druggist. If the word "chemor" were adopted for the first meaning, we might still have "manufacturing chemists" as well as "industrial chemors." The "pharmaceutical chemor" might or might not be a "chemist," according as he made or dealt in chemicals or not. If he were a teacher of pharmacy, he would probably be a "chemor," but not a chemist. The mere "chemist" would be assumed to have only a slight knowledge of the science. By virtue of study a "chemist" could become a "chemor." The chemor would **be versed therein.** The Association of Official Agricultural Chemors would admit no mere "chemist" to its membership though "chemists" might have a society amongst themselves for discussion of problems of the chemical trade.

In my mind the only objection to the adoption of "Chemor" in Canada is that until the other English-speaking countries followed our example, the old ambiguity would continue in the language. This is not a serious objection, but would it not be better to secure the co-operation of British and American "Chemors" beforehand?

J. F. SNELL,
August 16th, 1922 Macdonald College.

THE MINERAL PRODUCTION IN CANADA

During the Six Months Ending June 30th, 1922

According to a survey made by the Dominion Bureau of Statistics, Mining, Metallurgical and Chemical Branch, S. J. Cook, Chief, the total estimated value of the mineral production during the first six months of 1922 was $57,682.944 in which $26,475,544 represented the value of the metal production and $31,207,400 the non-metals. As compared with the same period in 1921, the value of the metals increased about two million dollars, or 9.1 per cent.

The standing of the different provinces in the Dominion, according to the return for the half-year was as follows: Ontario, $18,833,577; British Columbia, $16,153,307; Alberta $10,062,318; Nova Scotia, $8,792,799; Quebec, $2,054,455; Yukon, $714,652; New Brunswick, $590,456; Saskatchewan, $266,041; Manitoba, $215,339.

The ten principal products of the mineral industry in Canada during the period in order of the values assigned were: Coal, $24,346,959; gold, $12,110,242; silver, $5,997,199; lead, $2,882,047; natural gas, $2,448,829; copper, $2,337,093; asbestos, $1,894,232; nickel, $1,401,820; zinc, $1,370,460; and salt, $849,133.

Excluding the value of natural gas, the total value of the production of these commodities during the period was $52,340,052, as against $59,615,309 during the first six months of 1921. The decrease amounted to 12.2 per cent., and was due largely to the slackness in shipments of coal and the weakness of the nickel and copper production.

The outstanding feature of the metal production was the excellent gains made in the output of gold by the two important producing provinces, Ontario and British Columbia. The total for Canada during the period amounted to about 63 per cent. of the whole 1921 production, and increase of 42 per cent. over the production during the six months of that year. The increased prices and the lively markets for silver and lead were reflected in excellent gains in production over the half-year of 1921. The zinc production remained about the same, cobalt increased slightly, while copper and nickel, as might have been expected, fell off considerably.

COMPARATIVE TABLE OF MINERAL PRODUCTION OF CANADA FOR THE PERIODS ENDING JUNE 30th IN 1921 AND 1922

Production	1921 Jan. 1 to June 30		1922 Jan. 1 to June 30	
	Quantity	Value	Quantity	Value
Metallics		$		$
Cobalt, metallic and contained in oxide........Lbs.	109,440	328,320	125,561	376,683
Copper................ "	25,707,301	3,213,412	17,941,755	2,337,093
Gold...............Fine ozs.	396,391	8,194,129	585,833	12,110,242
Iron ore, sold for export. Tons	20	110	....	....
Lead...................Lbs.	32,875,616	1,883,772	47,747,627	2,882,047
Nickel............... "	12,948,454	5,360,660	4,005,199	1,401,820
Silver..............Fine ozs.	6,545,481	3,914,852	8,905,454	5,997,199
Zinc...................Lbs.	28,236,103	1,369,168	28,164,000	1,370,460
Total................	....	24,264,423	....	26,475,544
Non-Metallics				
Actinolite.... ....Tons	....	....	....	......
Arsenic, white.......... "	558	87,483	1,219	163,318
Asbestos.............. "	42,680	2,708,338	54,846	1,894,232
Barytes.............. "	174	5,993	28	909
Chromite............. "	Not available		498	4,980
Coal................. "	5,739,810	32,970,978	4,984,520	24,346,959
Corundum............. "	....	....	....	....
Feldspar............. "	13,770	101,452	13,525	108,405
Fluorspar............ "	3,532	85,481	356	2,343
Graphite............. "	570	40,166	334	17,528
Grindstones.......... "	Not available		659	32,200
Gypsum............... "	148,532	662,853	190,819	781,215
Magnesite............ "	1,403	29,456	1,361	36,189
Magnesium Sulphate.... "	426	9,891	736	18,059
Manganese............ "	28	1,680	27	681
Mica................. "	Not available		302	39,807
Mineral Water..........Gal.	"	"	....	5,264
Natural Gas.......M. cu. ft.	"	"	8,050,724	2,448,829
Iron Oxides............Tons	4,309	56,927	1,921	42,083
Peat................. "	Not available		2,250	11,250
Petroleum, crude.......Brls.	92,242	284,412	83,316	256,291
Phosphate.............Tons	....	....	90	1,060
Pyrites.............. "	16,218	53,769	9,473	39,751
Quartz............... "	34,244	130,286	18,225	36,539
Salt................. "	59,574	723,657	89,393	849,133
Sodium Sulphate....... "	Not available		92	1,380
Talc................. "	Not available		4,890	67,180
Tripolite............ "	110	2,750	55	1,815
Total Non-Metallics..	....	....	....	31,207,400
Grand Total.........	....	....	....	57,682,944

MINERAL PRODUCTION BY PROVINCES DURING FIRST SIX MONTHS, 1922

	1922 Jan. 1st to June 30th	
	Value of Production	Percent of Total
	$	%
Nova Scotia	8,792,799	15.4
New Brunswick........................	590,456	1.0
Quebec..............................	2,054,455	3.7
Ontario.............................	18,833,577	32.6
Manitoba............................	215,339	0.3
Saskatchewan.........................	266,041	0.4
Alberta.............................	10,062,318	17.4
British Columbia.....................	16,153,307	28.0
Yukon...............................	714,652	1.2
Dominion Total......................	57,682,944	100.0

Physical Testing Graphs*

Proposed Standardized Form for Illustrating Physical Tests on Vulcanized Rubber

By W. B. Wiegand
General Manager, Ames, Holden, McCready, Limited, Montreal

STANDARDIZATION always pays, so I make no apology for this attempt to propound and defend a standardized form for exhibiting the results of the commoner physical tests on vulcanized rubber. Two objects have been sought, First, optimum arrangement of data, and second, suppression of non-significant variations.

Arrangement

On the left side of the page, against cure in three-minute scale divisions as abscissæ, are shown as ordinates the three quantities, breaking tensile, breaking elongation, and sub-permanent set after rupture. These three factors constitute what one may call the classic group of physical criteria.

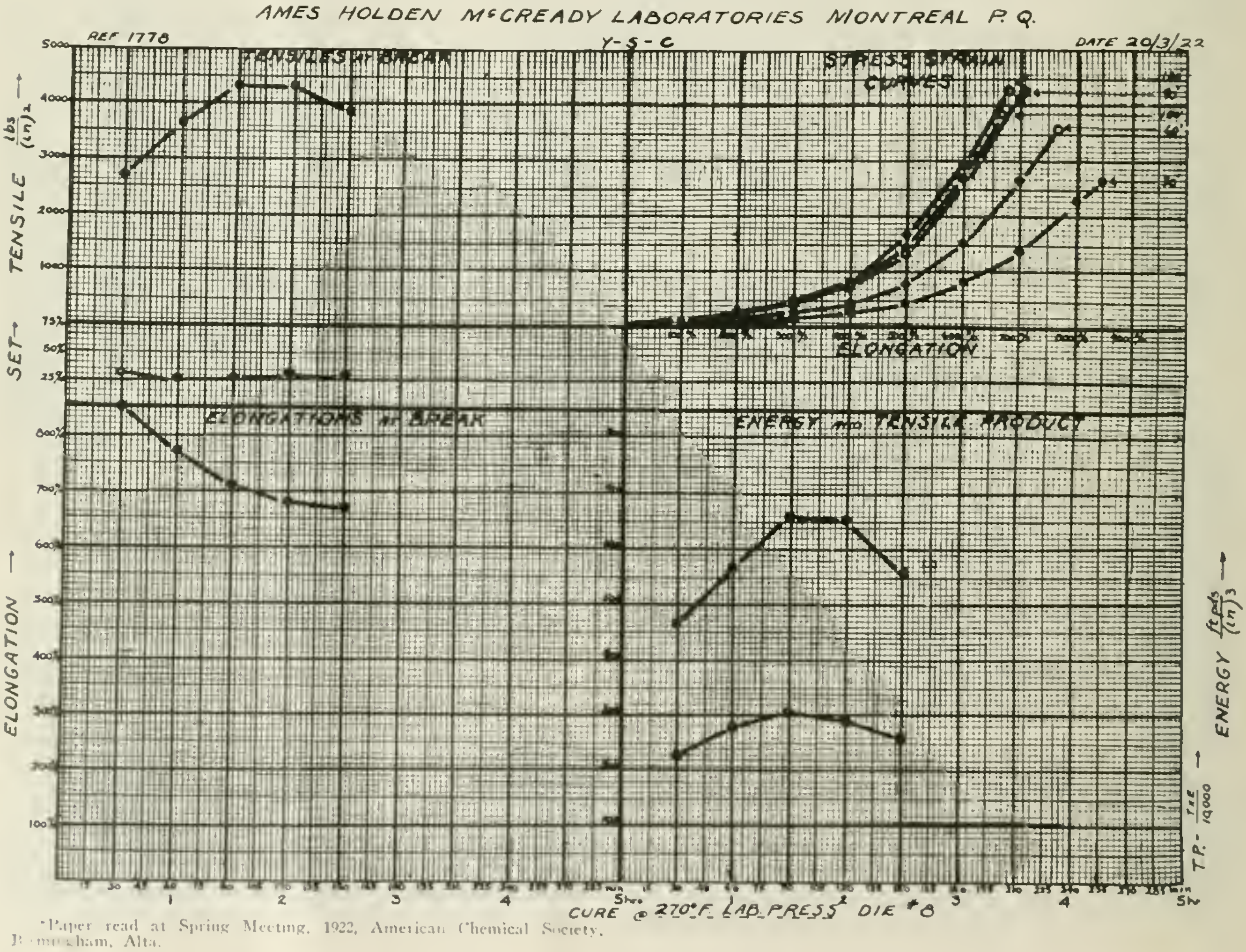
In the right upper quadrant are the stress-strain curves with elongations as abscissæ and original (left-hand) tensile scale as ordinates. In the lower right quadrant are energy of resilience and tensile product on an upright scale against a replica of the curing scale shown at the left. The merits or demerits of this arrangement will suggest themselves as you inspect the sheet, and I need not unduly expatiate.

Coming now to the choice of scale, I wish first to defend the plotting of the tensiles as ordinates, instead of as abscissæ. The latter method is quite common on the continent, and is also used by some workers on this side. Speaking first in a general way, the equation $y = f(x)$ is, I think, universally plotted with values for y as ordinates, and those for x as abscissæ. That is, the independent variable is laid horizontally, and the dependent variable vertically.

Examples of this can be drawn from many fields of scientific work. If you are plotting vapor tensions against concentrations of solutions, you plot the independent variable, the concentrations as abscissæ, measure the vapor tension and plot it as an ordinate. In the Lefax system, where the independent variable is the month of the year or the day of the month, you will always find these values horizontal, and the resulting profits, (or to be up-to-date, deficits) are shown as ordinates.

Now, in rubber testing on this continent, by far the commonest machine is that of the type of the Scott tester, where stress-strain curves are obtained by making the elongation the independent variable, and measuring the corresponding tensile. It therefore would seem most consistent to lay these fixed parameters horizontally. The same argument of course, applies to curing curves, where the cure is invariably laid horizontally, and the elongations now become the dependent variable, and so are plotted vertically.

The question arises as to whether the opposite method has any practical advantages which more than compensate for its irregularity. I understand that the Schopper testing machine records tensiles horizontally and elongations vertically, but the



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*Paper read at Spring Meeting, 1922, American Chemical Society, Birmingham, Alta.

graph thus obtained runs to the left instead of to the right, so that even the Schopper diagram has to be rotated through 180° to bring it into the standard form.

I submit that it should be no more trouble for those who use Schopper machines to make the 90° rotation necessary to bring their curves into agreement with the method here advocated. I believe it is also true that in the case of those who use Schwartz and Breuil testing machines it would be no extra work on their part to exhibit their curves in this manner, which is standard in engineering practice.

From the standpoint of hysteresis loops, the use of a vertical tensile scale brings the figures into harmony with those used by engineers in connection with magnetic and other hysteresis phenomena. From the standpoint of energy of resilience, which is measured by the area sub-tended by the curve, it is common practice everywhere to show forces as ordinates and lengths as abscissæ. The familiar PV diagram in the study of gas laws will occur to you in this connection. It is an interesting fact that when engineers do physical tests on metals, they arbitrarily fix the load and measure the extension, and yet they are quite willing to plot their curves with tensiles upright to bring their results into line with the general practice.

Thus, on the left side, tensiles are shown to 5,000 pounds per square inch, sub-permanent set at break to 75% (of the original length between bench-marks), and elongations to 850%, (and more, by a slight encroachment upon the "set" area).

Coming now to the suppression of non-significant variations, scale divisions run twenty to the inch with half-inch squares. This corresponds to 100 lbs. per square inch in tensile to each scale division, 5% of sub-permanent set to each division, and 10% elongation to each division. I have chosen these values as corresponding to the error inherent in rubber testing as ordinarily carried out. I don't think anyone would attach serious significance to the difference between two stocks, one of which shows 3,000 lbs. tensile strength and the other, 2,900. Using bench-marks one or two inches apart, and with ordinary refinement in marking, elongations cannot practically be determined closer than 10% absolute value. Sub-permanent set values differing by less than 5% are not in our experience significant. Again, as to the curing scale on the X axis, a 5-hour curing range with a 3-minute unit of division has turned out to be of sufficient refinement for most technical work.

For work in connection with ultra accelerators where the cures are cut down to one minute, the figures showing the hours can be used as minutes. For general factory purposes, however, it is hardly likely that large-scale operations will ever be carried out with compounds depending for proper vulcanization on curing intervals of less than three minutes, this by virtue of the natural limitations due to thickness of stock and lag in temperature.

Now, assuming that the lines used in graphing may run up to 1/20″ in width or at any rate that the circles marking the determinations are of that diameter, we see that differences in tensile, set or elongation shown on the chart indicate, under favorable conditions, **significant** differences in the rubber tested, and conversely one is not called upon to interpret irregularities in the trend of a line which in all likelihood represent only errors of technique.

The choice of this scale in no sense obscures genuine variability, nor on the other hand does it obscure errors in testing due to inaccurate compounding or curing, etc. It only submerges such errors as come within the range of accidental error inherent in the testing machinery under the very best of conditions.

Stress-Strain Curve Plotting

The same unit scale divisions as apply at the left side of the chart apply also to the stress-strain curve, and you will notice that the effect is apparently to shrink the scale of stress-strain curves below what one might at first blush regard as a desirable limit. It is common practice to display huge open-scale stress-strain curves, but our experience has been that a considerable amount of useless speculation can be obviated by shrinking the scale to a point where only significant differences appear. Thus, for example, in the case of flat curing compounds, it is quite common, as in the case of the sample blueprints which I have passed around, for a series of cures to result in a batch of curves, which on this scale, overlap to form an almost solid line. In our opinion, this overlapping is really essential to clarity of interpretation, corresponding as it does to the facts.

Progression and regression of the stress-strain curve appear on the graph only when they are of a magnitude greater than that of the experimental error of the determinations. The moment a series of curves overlap to form a single line, the graph tells us that we need suspect no significant displacement with advancing cure. Areas under the stress-strain curve can be conveniently determined by the method of additive tensiles or by counting the squares, or of course very accurately by the planimeter.

Coming now to the lower right quadrant, here we show energy of resilience and tensile product on the same scale, extending up to 800 units. The two scales are combined because these two quantities do not commonly overlap, this by virtue of their conventionally accepted units. One division in the energy scale corresponds to ten foot pounds per cubic inch of rubber, and one division also equals ten units of tensile product as defined in the right hand margin. These units also were carefully selected to achieve suppression of accidental error. Thus, for example, an error of one scale division in tensile strength, combined with an error of the same extent and kind, in elongation, produces an error of approximately one scale division in the tensile product.

Such a suppression of accidental error is of distinct value in estimating optimum cures. When a curve in any of these quadrants shows upward convexity, it is attributable to actual optima in the properties. Moreover, the convexity is neither exaggerated nor minimized, so that the effect of a given variation in time of cure can be properly assessed as to its effect on the properties of the product.

Application of the Chart to the Selection of Optimum Cures

For the purpose of accelerator research, where a definite criterion of speed of cure is desirable, the apex of the tensile product curve would probably be the choice of most workers. This would be determined from the lower right quadrant. The choice of an optimum cure in the technical sense would in general be a totally different procedure, depending on the type of compound, grade of compound, conditions of service, etc.

The old-fashioned method of observing the trend of the tensiles at break in relation to the sub-permanent set and to the breaking elongations, all three being plotted against the time of cure as on the left half of the sheet, still has much to recommend it. For press-cured samples, sub-permanent set might be regarded as a not very useful adjunct to this series, but for dry heat footwear compounds, particularly where meant for use in uppers, also tubes, the choice of a technical optimum often leans strongly towards the undercured side, and in such work we have found the consistent study of sub-permanent set extremely valuable.

The onset of reversion, that most treacherous of technical problems, may be clearly recognized by an examination of the left-hand series of data, without reference to the stress-strain curves at all. Thus, a markedly downward sloping tensile curve combined with an upward sloping set and elongation curve, clearly marks the reversion phenomenon. Confirmation of this is of course desirable, and is had by reference to the upper right quadrant.

Stress-strain curves however, cost money, and our experience has been that a large proportion of the laboratory control of factory stocks can be sufficiently well carried out by filling in only the left half of the sheet. For research work, all four quadrants are needed, and, as well, other data such as conductivities, hardness, etc., which are not provided for in this chart.

Application of Chart to Compounding Research

So much for curing tests. Where the compound is varied, we simply use the X axis by replacing time of cure by volume percentage of pigment, grade or fineness of pigment, etc., using the values for tensile, elongation, etc., that belong to the optimum cure for each compound.

The energy curve which for changing cures usually follows very closely the tensile product curve, and so offers little assistance in the selection of optimum cure, becomes of paramount importance in the determination of **optimum loading** or the comparison of one pigment with another. This energy factor is indeed being gradually adopted on both sides of the water, as perhaps the most complete single measure of toughness or general "tone" of a stock.

Thus while for curing tests the half of the chart suffices in many cases, for work on compounding ingredients, the right half is perhaps the more important.

I have purposely made no reference to **methods** of physical testing. You have appointed a committee to report on this vital phase of standardization, and I am sure we shall all be glad to co-operate in adopting where possible their recommendations when they are offered.

This brief account of one method of combining the results of the commoner tests into a single picture is offered in the hope of stimulating thought along the line of securing greater uniformity in the representation of such results and so of facilitating comparison.

PRODUCTION OF IRON AND STEEL IN CANADA

FUEL SHORTAGE RESPONSIBLE FOR PRODUCTION DECLINE DURING AUGUST

Pig Iron and Ferro-Alloys

The production of pig iron suffered a decline of 14.45% in August as compared with the record of the previous month. The output in the month under review was 27,123 gross tons as compared with a production of 31,705 tons in July, involving a decrease of 4,582 tons. The August output represents an increase of 16.09% over the record for May, constituting the minimum production of the present year. The principal grades produced in August were 20,494 tons of basic pig for further use, and 6,296 tons of foundry iron intended for sale. Fifty-two tons of foundry iron was made for further use, and 281 tons of malleable iron was manufactured for sale.

A comparison with the statistics of last year, indicates the quiet tone from which the industry has not yet emerged. The pig iron output in August, 1921, was 50,156 tons comprising an excess of 23,033 tons, or 45.9% over the record for the corresponding month of this year. The cumulative production during the first eight months of last year was 413,448 tons as compared with a total of 251,015 tons during the corresponding period of 1922. The difference represents a decline of 39.28%.

The ferro-alloy production in August increased by three per cent. over the record for July. The absolute quantities were 1,864 tons in August, and 1,809 tons in the previous month, comprising an increase of fifty-five tons. The cumulative output for the first eight months of this year was 13,344 tons as compared with a production of 17,784 tons during the corresponding period of last year, constituting a decline from last year's record by 4,440 tons or 24.9%. The output in August consisted chiefly of 50 and 75% ferro-silicon produced for sale.

Notwithstanding advancing prices and favorable marketing conditions, production slackened perceptibly during August. The fuel shortage was the principal cause of the recession bearing specially hard on the industry in question. Upon the settlement of the coal and rail strikes, considerable improvement may be expected.

Steel Ingots and Castings

Steel production declined to 59,201 long tons in August, as compared with an output of 62,767 tons during the previous month. The decrease is equivalent to 3,566 tons or 5.68%. The output in August is also less than that of the corresponding month last year by 12,822 tons, representing a decrease of 17.8%. The cumulative production for the first eight months of the present year was 299,048 tons involving a decrease from the output during the same period of 1921 by 122,093 tons or 29%. The absolute quantity produced in the eight month period last year was 421,141 tons. The average production in August for the three-year period from 1919 to 1921 was 76,964 tons which is in excess of the output of the month under review by 30%.

The 56,997 tons of ingots were open hearth basic steel intended for further use. The production of ingots in August was 56,997 tons or 6.9% less than the output in the previous month when 61,243 tons were reported. In August, 1921, 70,339 tons were produced comprising an excess of 13,342 tons, or 23.4% over the output of the month under review.

The output of direct castings increased from a production of 1,519 tons in July to 2,204 tons in the following month. The increase represented 685 tons or 45%. The total production of castings for the last eight months was 13,044 tons as compared with an output of 17,628 tons during the corresponding period of the previous year. The decline comprises 4,584 tons, or 26%. The principal grade produced in August was 1,128 tons of bessemer castings of which 1,118 tons were made for sale. Castings made in electric furnaces for sale were reported to the amount of 738 tons and 130 tons were manufactured for further use.—From Report of Dominion Bureau of Statistics, Mining, Metallurgical and Chemical Branch, S. J. Cook, Chief.

EXTENSION COURSE IN INDUSTRIAL METALLOGRAPHY

Under the auspices of the Department of Metallurgy at McGill University, an extension course in Metallography will be given as in previous years, by Messrs. Harold J. Roast, F.C.S., F.C.I.C., and Charles F. Pascoe, F.C.I.C.

The course consists of fifteen periods, held on Monday nights, at the Chemistry and Mining Building, McGill University, commencing on Monday, November the 6th, at 8 p.m.

Application should be made to either of the lecturers, their address being McGill University, department of Metallurgy.

The fee for the course is $20.00, payable to the Bursar.

In-as-much as only twelve members can be accommodated at one time, students will be enrolled in the order of their applications.

In past years the class has been composed of mechanics, engineers, chemists, and those desiring a winter hobby, or whose business brings them in contact with metals and who desire to have more knowledge of their composition. No previous knowledge is assumed, and the course is essentially practical from first to last.

If any students from a previous year desire to continue their work, provision will be made for an advanced course if sufficient members are obtained.

Ferrous and non-ferrous metals are dealt with equally, training being given in preparing them for examination under the microscope, and finally photographing the various structures developed.

HEALTH LABORATORY FOR NIAGARA FALLS

The Ontario Government will establish a Provincial Health Laboratory at Niagara Falls to serve the Counties of Welland, Lincoln and Haldimand. The new laboratory will be installed at the Niagara Falls hospital and the operating expenses will be borne by the Provincial Board of Health.

Meeting of Maritime Chemists' Association

Fifth Annual Meeting, Held at Halifax, N.S., August 30th and 31st, 1922

CHEMISTRY and chemists in eastern Canada are kept very much alive by this active organization. Halifax was chosen as the place of organization, five years ago, and again entertained the chemists of New Brunswick and Nova Scotia. Unfortunately, one of the chief organizers, the late Professor E. B. MacKay, of Dalhousie University, is no longer present to inspire, but others are carrying forward the work with most inspiring energy. This is the first year that the committee ventured to plan a two-day session, and their wisdom was entirely justified. On August 30th and 31st, meetings were held in the Technical College, and a very fine program of papers was presented.

The session was opened by a most important business meeting, with Professor L. C. Harlow, of Truro, N.S., presiding as president, and Professor D. U. Hill, as secretary. Professor Harlow opened the meeting with a few very appropriate remarks, dealing with the aims of the organization and the work it had accomplished. He welcomed the visitors present, and thanked the local organization for their efforts in preparing for the event. He pointed out that through their Association, chemists have secured inspiration, information and intimacy, all three necessary to good work, co-operation and the development of a professional feeling. Professor Hill reported the financial status of organization and read correspondence from absent members, particularly the original secretary, Dr. H. B. Vickery, now at Yale. Officers for the session 1922-23 were elected as follows:

President, C. C. Forward, Halifax; Secretary-Treasurer, Prof. D. U. Hill, Wolfville, N.S.; Vice-Presidents, T. C. Mackie, Sydney; Prof. H. W. McKiel, Sackville, N.S.; Executive, Prof. L. C. Harlow and Mr. Kelsall.

It was proposed for next year that a trip be taken through the Annapolis Valley, where many things of interest to chemists could be seen. The trip would be of particular interest to agricultural chemists and those interested in the canning, vinegar and fertilizer industries.

The question of the formation of a Maritime Branch of the Canadian Institute was introduced by Dr. H. E. Bigelow, and a number of motions were presented by Prof. Hill, whereby the present Maritime Chemists' Association could gradually merge into the Institute. It was felt that practically all those who had shown a continued interest in the Association had the qualifications necessary to join the Institute, and that it was desirable to take this step. A Committee was appointed to make a direct application to the Council of the Institute for the formation of the new branch and was signed by all members of the Institute present, as well as all those members of the Maritime Association who were making application for admission to the Dominion Association. The branch in all probability will be formed immediately and by another year should be in a position to hold a joint meeting with the Maritime Association, at which time the necessity for any further activities of the original association may be finally considered. It would appear very probable that the Maritime Branch of the Institute will take over the activities of the Maritime Chemists' Association, thereby securing a definite link with members of the Institute throughout the Dominion.

A dinner was given at the Green Lantern, which can be recommended to any chemist visiting Halifax as a desirable light by which to be guided, whenever nature craves a further supply of essential vitamines, etc. Mr. C. C. Forward, Dominion Public Analyst and President Elect, presided. He again welcomed the chemists to Halifax, and, in return, a number of visitors spoke briefly. These included: Prof. L. C. Harlow, Prof. H. J. Creighton of Swarthmore, Pa., who, although not residing (except during the summer), in his native province of Nova Scotia, was one of those active in the organization of chemical work and the Maritime Association, Dr. H. Bigelow, Dr. H. K. Mahbir, of Halifax, Dr. J. S. Bates, President of the Canadian Institute of Chemistry, and Mr. L. E. Westman, the Secretary.

The dinner was graced by the presence of a number of ladies, including the wives and friends of members.

A GROUP OF THOSE IN ATTENDANCE AT MEETING OF MARITIME CHEMISTS AT HALIFAX, Aug. 30-31

Top row, left to right—D. J. Matheson, Dr. L. C. Harlow, Prof. H. W. McKiel, Dr. J. S. Bates, B. G. Wood. Prof, H. E. Bigelow. L. Smith.

Bottom row, left to right—W. T. Dawson, Prof. D. U. Hill, K. L. Dawson, R. F. Dimmitt, L. E. Westman. C. C. Forward.

Three papers were given at the evening session. They were, in general, of a highly interesting and entertaining type, the subject matter being drawn from border-line material, where chemistry has considerable to do with other scientific work.

Industrial Hygiene and Efficiency

Dr. H. K. Mahibir delivered an address on Industrial Hygiene and Efficiency, which practically summarized the best ideas developed on these subjects. His experience in army and industrial work has been quite large, and he pointed out the very significant data that was already available. Just as industrial operations were controlled by a most exact chemical science, so the activities of the worker could be made the subject of scientific study. He reviewed and compared conditions one hundred years ago with those of the present day. Times have changed since the rule for children in the textile mills made it necessary for the firm to take over one idiot with every twenty sound children, when dealing with institutions supplying child labor. He stated that at one time a fine of one shilling was imposed on the worker for such offences as opening a window, whistling or washing during the hours of labor. He reviewed advances in the science of preventing occupational diseases, and pointed out the physical, mental and educational factors necessary to complete industrial efficiency.

Chemical Reactions Due to Mountain Climbing

Mr. W. T. Dawson, a graduate of Mt. Allison, who has recently returned from Oxford, gave a very delightful paper on some chemical reactions in the human body during mountain climbing. He gave a most modern conception of the reactions going forward as the amount of oxygen per unit volume decreases. After describing general effects in specific cases of mountain climbers, he illustrated, by drawings, the various blood vessels and membranes playing a part in the sustenance of normal conditions. The extremely delicate balance maintained in acidity and alkalivity of the blood and the nerve control of the same, made a subject around which a very considerable amount of chemical and physical theory can be developed.

Effects of Chemicals in Gelatine

Dr. S. G. Ritchie described some reactions, where various chemicals are allowed to come in contact in gelatine. The typical banded structure was discussed, along with various theories relating to possible solutions for the effect. Dr. Ritchie was lead to make these experiments while studying the basic problem of cell formation. He developed some of the general terminology and mathematics of colloids, and his slides were particularly interesting. It was obvious that they had been prepared with unusual skill. The formations taken up by various drops, joined together, reminded one very much of the cell structural of typical bone and other tissue. Dr. Ritchie is combining a fundamental knowledge of colloid chemistry with dental research work.

Discussion on Teaching of Chemistry

On Thursday morning, a general discussion, relating to the teaching of chemistry in the schools of the Eastern Provinces, took place. Mr. D. J. Matheson, of the Halifax Academy, outlined his methods in a general way. He took up the question under the heads: Recitation, demonstration, laboratory and lectures. It appears that the teachers, in some instances, are given larger classes than would be ideal, and have not the necessary equipment. They also have many subjects to cover. Dr. Waddell, of Queen's University, who is directly associated with the schools of Nova Scotia, outlined what he considered sound teaching methods and what should be aimed at. Dr. Bigelow, speaking from the standpoint of a professor whose duty it was to carry forward the elementary work, regretted that conditions were not in general much better, and thought that while students might be well advanced in a knowledge of certain facts, they were far behind in their knowledge of elementary generalities, which should be easily within their power to grasp. Dr. Bates suggested that, since the actual number of chemical individuals largely used in industry and in ordinary, everyday life, was small, these should be stressed and used as a basis. He suggested that air, water and lime were three good examples, and that chemical principles could be developed around well-known subject matter. Dr. Harlow spoke of the general benefits to be secured from a broader conception in the minds of students of the very practical place chemistry had in industry, agriculture, household science, etc. L. E. Westman pointed out the necessity of making chemistry a very desirable course for students, taking general work in arts, as a knowledge of the subject in the hands of all university graduates made it easier for specialists to secure support in their work in chemical control and conservation of resources. He also thought the university teachers might make a better effort to prepare undergraduates for actual industrial research or chemical positions as superintendents and business executives. Suitable lectures given by men experienced in industrial and business life would help to broaden the students' viewpoint.

Chemistry of Pulp and Paper Making

Dr. J. S. Bates presented a paper on the pulp and paper industry. He gave, in skeleton form, all the various branches of the industry and outlined the various chemical methods employed in manufacturing, dealing with sulphite, soda and Kraft processes. He spoke of the technical section of the Pulp and Paper Association, showing how this organization of technical men had helped the business. Some of the general problems presented by Dr. Bates to the Research Council for consideration were reviewed. He divided the profitable research work, which might be done, under the following heads: 1) Chemistry of wood; (2) Analytical methods and study of typical groups of substances such as turpentine group, lignin group, alcohol group, etc. The ideal would be to devise a process using everything in the wood. (3) Chemistry of pulp and possible pulp products; (4) Cooking problems; (5) Standard methods of testing pulp and paper; (6) Study of new woods and wood destroying fungi. Already textbooks have been produced for workers in pulp and paper, and the research committee are planning to undertake co-operative research in a large way very shortly.

Government Control of Food Standards

Mr. C. C. Forward gave a paper on Food Standards, showing the necessity for Government control, and the very useful work that has been done to date. New foods and new processes of manufacture make the work continuous. Canada has her own specific problems in this line, and her own standards. The creation of a standard must be given consideration from every standpoint, and the standard must be one which can be generally applied. Since 1887, when the work began, adulteration has continually fallen off, and, at the present time, Canadian food products are pretty much what they are claimed to be.

Visit to Industries

On Thursday afternoon, the plant of the Acadia Sugar Refinery and the Imperial Oil Company's Refinery were visited. These are located on the Dartmouth side of the harbor, and are very large works. Both were operating to capacity. The Imperial Oil Company has 500 acres at this point, and secure their crude oil from Mexico by boat. This is probably the second largest plant in Canada, being only exceeded by the Sarnia plant of the same company. The chief product here is gasoline, the plant not being so well situated to produce other oil products. The refinery is situated on rising ground, so that the view of the works from the harbor is most striking. During the two days, the cars of the local committee were much at the disposal of visitors, and the many beauty spots of one of Canada's leading historical and commercial cities were admired by them.

Among those registering at the opening session were:

J. G. Greenham, Halifax,

K. L. Dawson, Halifax,
R. F. Dimmitt, Halifax,
C. C. Forward, Halifax,
D. J. Matheson, Halifax,
L. C. Harlow, Truro,
H. W. McKiel, Sackville,
J. S. Bates, Bathurst,
John Waddell, Kingston,
L. E. Westman, Toronto.
H. E. Bigelow, Sackville,
G. S. Lordly, St. John,
B. G. Wood, Halifax,
L. Smith, Halifax,
J. C. Mackie, Sydney,
W. C. Carter, Sydney,
G. A. Coffin, Sydney,
G. H. McPherson, Truro.
W. A. DeLong, Halifax,
G. F. Murphy, Halifax,
D. U. Hill, Wolfville,
H. J. Creighton, Swarthmore, Pa.
S. J. Ritchie, Halifax.
W. N. Dawson, Halifax.

MEMBERS OF AMERICAN CERAMIC SOCIETY VISIT CANADA

Owing to the haste in getting out our September issue in advance of the New York Chemical Exposition, we were unable to say anything in that number regarding the visit of American Ceramic Society members to Quebec and Ontario during the week of August 14th. The occasion was the annual summer meeting of the Society and as is customary with the summer meetings no technical sessions were held, the week being given over to a trip which covered points of ceramic interest between Montreal and Toronto.

The party consisting of about fifty members, arrived at Montreal by steamer from Rochester. First an inspection of Montreal harbor was made, after which the party divided, one group crossing the river and visiting the plant of the National Brick Co., Ltd. at Laprairie and the other the works of the Consumer's Glass Co. Common brick, face brick, and hollow tile are manufactured at the National's four plants at Laprairie, the common brick plant having a capacity of 65,000,000 bricks a year. At the glass works, bottles of various sizes and shapes were seen in process of manufacture by O'Neill semi-automatic machines, equipped with Federal Glass Co. feeders.

Wednesday morning the party left for Ottawa, stopping at Buckingham where motors conveyed the party some ten miles to the Derry feldspar quarry. This deposit has a maximum width of 150 feet, about 50 feet being practically pure feldspar, the remainder consisting of mixed feldspar and quartz. The quarry was opened in 1920 by O'Brien and Fowler and the feldspar analyzes potash 12.5 to 13.5% potash and 1.75 to 2.15% soda. In summer the feldspar is drawn two miles by wagon to the Lievre River, placed in scows and towed to the railway siding at Buckingham. In winter the entire journey is made by sleighs, using the frozen surface of the river as roadway for the greater part of the distance. The inspection of the quarry concluded with camp-style dinner served in the mess hall at the quarry.

Visit to Ottawa, Hull and Verona

Arriving at Ottawa late Wednesday afternoon, dinner was taken at Ye Olde Homestead Inn, across the river, after which a visit was paid to the Ceramic Laboratories of the Department of Mines, under the guidance of Mr. McLeish, director and Mr. Frechette in charge of Ceramic work. Thursday morning the plant of the E. B. Eddy Company at Hull was inspected. After lunch the party left by train to visit the Richardson feldspar quarry near Verona in Frontenac County, which supplied most of the feldspar to the United States from 1901 to 1918. The long haul of four miles over extremely rocky ground to the railway, proved too expensive a proposition, and since 1918 the quarry has not been operated. However, arrangements are now being made by R. F. Segsworth of Toronto, the present owner, to have the C.P.R. siding extended to within two miles of the deposit. This is now being done, and the intervening roadway put in shape so that future operations should prove successful. The quarry is about 400 feet long by 150 feet wide and 100 feet deep, about half of the deposit being high grade feldspar, the remainder requires sorting. Leaving Verona, the next stop was Kingston where an elaborate program had been arranged by the local Council, but unfortunately there was only time for dinner at the Frontenac Club and a hurried inspection of Memorial Hall, after which the train was boarded for Toronto.

Toronto and Hamilton

After inspecting the Toronto Harbor developments, the party divided one section visiting the Standard Sanitary Works and the other the Jefferson Glass Co. At the latter plant arc and street light globes, and electric lamp shades were seen in process of making.

The journey to Hamilton was made by boat, Saturday morning where the plants of the Canadian Libbey-Owens Sheet Glass Co., the Dominion Glass Co. and the General Porcelain Co. were visited. At the Porcelain Co., the manufacture of high tension insulators proved very interesting, while the most modern processes for making window glass were viewed at the Libbey-Owens works. At the Dominion Glass Co., Owens automatic bottle machines are in operation.

The Hamilton visits concluded a week that did much to strengthen the bonds of friendship already existing between American and Canadian Ceramists.

SULPHURIC ACID TOWERS

British Patent No. 172,000 is concerned with a method of constructing the towers used in the manufacture of sulphuric acid so as to render the intensity of the re-action as uniform as possible.

The towers are divided into sections by inserting therein horizontal lead tubes. Water from the tubes in the hottest part of the tower is caused to flow through the tubes in the cooler portions, conveying heat thereto. The towers are made with a rectangular section preferably; the sections are separated by semi-pervious partitions, which allow the liquids to pass through, but do not permit the flow of gases, the latter consequently assuming a horizontal path through the apparatus. The acid-proof filling is arranged in such a manner as to facilitate this mode of operation.

PERSONAL

Mr. W. B. Wiegand has been appointed General Manager of Ames-Holden McCready, Limited, Montreal. Mr. Wiegand is well known in the field of industrial chemistry in Canada, having written several important scientific papers on rubber. He is chairman of the Rubber Division of the American Chemical Society, and takes an active interest in the Society of Chemical Industry, and is also a Fellow of the Canadian Institute of Chemistry.

MARKING OF IMPORTED GOODS

An Order-in-Council, dated at Ottawa, September 21st, 1922, provides that from and after the 1st day of November, 1922, printed or lithographed matter of all kinds imported into Canada, (including books and pictures shall be marked, stamped, branded or labelled in legible English or French words, with the name of the country of origin. Wooden or fibre lead pencils are also included in the Order.

Members of American Electrochemical Society Assembled in Montreal for Annual Meeting.

Montreal Meeting, American Electrochemical Society

WITH a few words of welcome from Alderman Sibold and from Dr. R. F. Ruttan, representing the Society of Chemical Industry, the members of the American Electrochemical Society got down to business. Meetings were held at the Windsor Hotel, with President C. G. Schluederberg and Secretary C. G. Fink in command. The attendance was good and the program up to the standard. Of particular interest was the opportunity to visit Shawinigan Falls, where some well-known large electrochemical industries are located.

Prof. Ruttan's opening remarks were a happily blended welcome to Canada. The general question of industrial heating received considerable attention from a number of speakers, and was considered from various standpoints. Most of the papers presented were printed in advance, which facilitates the development of discussion.

Some of the principal papers read and discussed were: "The Dezincification of Brass," by R. B. Abrams.

The first step in this is the dissolving of the brass. The copper in solution can be re-deposited by the use of a membrane which keeps the dissolved copper in contact with the brass and the subsequent re-deposition of the copper. The word "dezincification" refers to brass which has undergone corrosion, for example, by sea-water, leaving a porous mass of seemingly metallic copper.

"Electroplated Zinc and Diffusion of Electro Deposits into Zinc," by W. G. Traub.

Copper, Brass, Gold and Silver, all diffuse into zinc, whereas Nickel does not, and can be used as a preventive of diffusion.

"Firing of Ceramics in Electric Furnaces," by E. T. Smalley.

Properly designed electric furnaces are dependable for ceramic firing at temperatures up to 1100°C. The electric furnace produces better grinding wheels in shorter time than a kiln process. The electric furnace is used in this way by automobile, china, glassware and bifocal lens industries, as the rejects are low.

"Electromosis and Electrophorisis," by Oliver C. Ralston.

An attempt to clear up the confusion in terms and more closely define certain electro-capillary phenomena. Four words are suggested: Electrolysis, Electrosmosis, Electrophorisis, Electrostenolysis, which should cover all general cases.

"A New Induction Furnace," by J. Murray Weed.

This is for non-ferrous metals, with an automatic air-directional circulation produced between molten charge and melting pot.

"Effect of Heat Treatment on the Hardness and Microstruction of Electrolytically Deposited Iron," by N. B. Pilling.

The problem of depositing upon worn or undersized parts a layer which could be machined to size, has been receiving considerable attention. The initial effect of annealing is a very marked hardening, reaching a maximum at 300° to 400°C. The initial brittleness is removed. Annealing at higher temperature results in progressive softening. A study of the rate of decomposition of the supposed unstable iron-hydrogen compound formed was made at different temperatures.

"Arc Action on Some Liquid Insulating Compounds," by C. J. Rodman.

Liquids with high dielectric strength, low viscosity, and comparatively high fire and flash points, were submitted to the action of the electric arc at and below the liquid surface. A high voltage, high frequency generator was used to disrupt the oil between ball electrodes. Halogenated aliphatic and aromatic hydrocarbons, and mixtures of these in some mineral oils, were tested. Decomposition products ran from carbon to nitrogen. With increase in molecular weight of the homologue series, the parafines show a decrease in gas evolution per kilowatt second of arc rupture. A mineral oil gave 97 c.c. gas per kilowatt second, while a highly chlorinated oil was as low as 4.2 c.c. The data obtained has a practical application in transformers, circuit breakers and condensers.

"Preparation of Perchlorates by heating Chlorates," by F. C. Mathers and J. Waldred.

Results obtained by heating chlorates to form per-chlorates indicated that no heating method was likely to equal the electrolytic.

"Principles of High Temperature Furnace Design," by E. L. Smalley.

This was a very practical paper, reviewing the principles of electric furnace design in detail.

"Electric Steam Generators and their Application," by P. S. Gregory.

Where costs permit, this method of steam generation is entirely satisfactory. The paper gave the plans of various generators with illustrations.

"Changes in the Electrical Conductivity of Varnishes during Drying," by H. C. P. Weber.

Certain insulating varnishes, products of an acidic nature, accumulate during the first operation of the machine and develop substances of low electrical resistance, with injurious effect.

"Resistivities of Some Granular Resistor Carbons," by C. Williams and G. Shuck.

The common resistors are "granular resistor carbon" and "granular resistor graphite," both made from petroleum coke. The relative resistivities of various types were measured. The paper is of very practical value to manufacturers of equipment using such materials.

"Effect of Impurities in Nickel Salts Used for Electrodeposition," by M. R. T. Thompson and C. T. Thomas.

The effect of various impurities is measured and analysis given of samples of commercial salts. Specifications for these salts are suggested and manufacturers have demonstrated a willingness to produce salts of desired purity.

"Some Electrical Properties of Alloys at High Temperatures," by M. A. Hunter and A. Jones.

There are two classes of commercial heating elements: (1) Those which require materials of high specific resistance at the operating temperature; (2) Those which have this first property and can withstand oxidation. The first class can be used at temperatures not above 500° C., and the second up to 1100°C. A study has been made of methods of determining specific resistance of commercial alloys at any operating temperature.

"The Development of Industrial Electric Heating for Low Temperature Enameling," by W. S. Scott.

The automotive industry has been responsible for the development of the electrically heated enameling oven. The article tells of the steps taken from the older method of gas-fired ovens to the present large-scale electrical units, operated under perfect control. Both the technique and the chemistry of the process has been very fully marked out.

"Prof. A. S. Eve, of the Department of Physics at McGill, gave a public lecture on "The New Philosophy of Physics," in which he developed modern conceptions of matter and energy in various forms. During the meeting, trips were made by members and ladies to interesting points around the city, including some of the leading Golf Clubs. On Friday evening, a Smoker was held by Section Q, which will long be remembered as a good evening's fun. The award of the Pickles Medal, the Contactometer and the personally conducted tour of South America, not to mention the vocal efforts of several members including a well-known Canadian chemist, made the meeting of this Section quite equal to the rest of the program. At 11 o'clock, the party left for Shawinigan Falls, where Saturday was spent visiting the power plants, paper mills and chemical works of this centre.

The local committee in charge had made every preparation, under the direction of the following: H. W. Matheson, chairman; C. R. Hazen, vice-Chairman; A. R. M. MacLean, excursions; Fred. Brown, smoker; W. B. Woodland, publicity; and Mrs. C. R. Hazen, ladies. Opinions as generally heard expressed the hope that the Society would again arrange in the near future to hold a Canadian meeting, preferably at Montreal. The next meeting will be held in New York City.

SUPERPHOSPHATE MANUFACTURE

United States Patent No. 1398816, assigned to the Southern Agricultural Chemical Co., is concerned with a process of manufacturing superphosphate.

The improvement claimed in this invention is concerned with the removal of the gases and vapors formed during the re-action of phosphate rock with sulphuric acid. The present invention provides a number of openings in the sides of the chamber, whereby the gases evolved within the re-action mass can escape readily. The advantage claimed is that the re-action between the rock and the acid is more complete, and the amount of insoluble phosphoric acid in the fertilizer is correspondingly reduced. Considerable time is also saved in the process.

American Chemical Society Holds Successful Meeting at Pittsburg

Report of Sixty-Fourth Meeting, September 4-8, 1922

OVER thirteen hundred members and guests of the American Chemical Society registered for the Sixty-Fourth Meeting of the Society, held at Pittsburgh, Pa., during the week of September 4th.

Four hundred and fifty-seven papers were presented during the week to the various divisions and sections, and a good average of excellence was mainained throughout with several above the average. There were few startling discoveries noted, that of greatest general interest, being probably Thomas Midgley's demonstration of his observations on accelerating and retarding catalysts in the combustion of petroleum hydrocarbons.

$25,000 Prize for Research

At the meeting of the Council of the Society on the opening day, it was announced by the President, Dr. Edgar F. Smith, that the Allied Chemical and Dye Corporation had advised the Council that they had decided to donate an annual prize of $25,000 to be given as a reward to the chemist in the United States, who in the opinion of a special committee shall have done the most to advance the science of chemistry. The award is to commence in 1923 and to continue perpetually. The Corporation desired that a committee of five should be formed of which Dr. Smith should be chairman, this committee to draw up regulations and to appoint the first years awarding committee or "jury." This jury is to consist of seven members of whom five shall be appointed by Dr. Smith's committee and two by the corporation. Workers in all fields of chemistry, industrial, teaching, and research included, are eligible for the award. The Council accepted the gift on behalf of the Society.

It was decided to hold the 1923 Fall Meeting at Milwaukee. The Spring 1923 Meeting will be held at New Haven, Conn.

The Council approved the plans for international editorial supervision and control of the "Journal of Physical Chemistry," hitherto published by W. D. Bancroft, whereby the journal will be published jointly by the Chemical Society (London, England) and the American Chemical Society, the publication expenses being met by the annual gift of $10,000 by the Chemical Foundation.

The General Meeting

J. O. Handy, chairman of the Pittsburgh Section, opened the general meeting of the Society. Addresses of welcome were made by S. H. Church, president of the Carnegie Institute, where the sessions were held, by Dr. John G. Bowman, Chancellor of the University of Pittsburgh, and Dr. Thomas S. Baker, acting president of the Carnegie Institute of Technology.

Dr. Charles L. Parsons then addressed the assembly telling of his European tour during the past summer. He referred to the success of the International Conference of Chemistry held at Lyons, its third annual meeting. He found complete cooperation among the representatives of the various nations.

Dr. E. E. Slosson, director of Science Service, Washington, followed Dr. Parsons with a masterly address on the "Status of the Chemist to-day." Dr. Slosson's address was replete with striking phrases, not a few of which were very humorous, such as—"Some want to keep science as a sport, and many fear that the chemist may lose his amateur standing if he makes any money." Referring to research, Dr. Slosson said "The great problem of chemistry is that of combustion. Every tiny grass blade points the finger of scorn at the chemist and says: 'See how we do it!' " In conclusion the speaker pleaded earnestly for works on chemistry and chemical phenomena expressed in non-technical language.

Control of Gaseous Detonation

The outstanding presentation during the week was the paper of Thomas Midgley, Jr., and T. A. Boyd on "The Chemical

Control of Gaseous Detonation, with Particular Reference to the Internal Combustion Engine." The work of the General Motors Research Corporation had for its object the conservation and economic utilization of motor fuel and the problem under discussion really resulted from the original study of developing a more efficient type of internal combustion engine. The phenomena of "knocking" is the only deterrent to the using of a high-compression motor instead of a low-compression motor. A high-compression motor offers a very effective economy in fuel consumption, for, by increasing the compression ratio, there is a more efficient utilization of the energy content of the fuel, but the "knocking" becomes so intensified in the high-compression motor that there is not only a serious loss of power, but often an actual damage to engine parts.

The investigations of Midgley have definitely shown that the chemical composition of the fuel is a controlling factor in causing and preventing "knocking." It was accidentally discovered that the addition of a small quantity of iodine to a gasoline fuel greatly lessened the tendency for a high pressure engine to "knock." After two years of research, a second compound of similar properties was discovered and about a year later, a third. Compounds were also indicated that would have the opposite effect and increase the "knocking." Iodine, Aniline, Diethyl Silenide, Diethyl Telluride, Tetra-Ethyl Tin and Tetra-Ethyl Lead are anti-knocking compounds of which the last mentioned proved the best, having about 1,500 times the power of benzine in preventing detonation. Bromine, Oxygen and Isopropyl Nitric act as accelerators of "knocking." Recent investigations have shown nickel carbonyl to be an excellent anti-knock and indications are that the corresponding platinum compound will prove a better one.

A high pressure gas engine was erected on the lecture platform and by means of a special apparatus it was possible to measure the detonating characteristics of the fuel. A gasoline fuel that produced loud knocking was corrected immediately by allowing very small amounts of the vapor of iodine or diethyl selenide to enter the breather of the motor. The tetra-ethyl lead mixture has already been used commercially in aeroplane and motor boat engines.

Mr. Midgely explained that these compounds have not yet been marketed as their real benefit cannot be obtained until gas engines have been re-designed to operate at higher compression. The new insight into the theory of catalysis forms the most important aspect of these discoveries from a scientific standpoint.

ABSTRACTS OF MORE IMPORTANT PAPERS

Factors Influencing the Efficiency of Alkali—Chlorine Cells

By W. P. Ryan, C. T. Harding and R. P. Russell

A study of the effect of Effluent Flow vs. Current Efficiency of four current densities shows that the efficiency increases rapidly with increased flow, approaching 100% asymphotically. A plot of Current Density vs. Effluent Flow at the guaranteed (92%) efficiency is of especial interest to plants forced to run at varying current densities because of the influence of seasonable changes on power supply.

The performance of an Allen Moore Cell was studied and the results show that increasing the Effluent Flow increased the Cathode Current Efficiency, the voltage and the energy efficiency, although the last decreases as high flows are reached. Increasing current density decreases the efficiency and increases the voltage at the rate of 0.01 volts per amp. per square foot. For 92% current efficiency the salt conversion is very close to 50%. For a given energy efficiency the flow is directly proportional to the current density. For a given current efficiency the flow is proportional to the current density above 75 amp. but falls off rapidly below that.

The Removal of Small Amounts of Carbon Monoxide From Gas Streams by Passing Over Heated Granular Soda Lime

By Robert E. Wilson

The problem of the complete removal of CO from gas streams is of importance in a number of industrial applications. One or two German patents have mentioned the use of granular soda lime at fairly high temperatures for the purpose, but they offer no quantitative data. This paper describes a series of experiments at temperatures varying from 250 to 550°C. and using soda limes of varying composition. The results show that high alkali soda limes give complete removal at the lowest temperature (around 350°C.), providing water vapor was present and hydrogen absent. In the presence of considerable amounts of hydrogen removal is not complete under any conditions tried.

The Solvent Properties of Acetone

By R. F. Remler

The paper takes up the following industrial consideration regarding acetone as a solvent: Uniformity of the present grade of acetone from calcium acetate, boiling point and volatility, freezing point, inflammability, dehydrating properties, miscibility with other solvents, use as a coupling or bending agent between immiscible solvents, relative cost per gallon, physiological effects and recovery of vapors. The solubility of acetylene, cellulose acetate and cellulose nitrate, rosin and mineral oils, gums, resins, shellacs, animal and vegetable oils, fats and greases, waxes, asphalts, and bitumens, are discussed. Mention is also made of acetone in the dry cleaning and leather industry, as a constituent of paint, varnish, and carbon removers.

The Plastometer as an Instrument for Process Control

By Eugene C. Bingham, H. D. Bruce, H. D. Wolbach

Recent work proves that the viscosity of colloidal solutions is not a physical constant as ordinarily measured, but varies with the shearing stress used, so that a certain paint showed a change in viscosity of ten per cent. when the shearing stress was trebled. Apparently this difficulty is not limited to any one class of colloids nor are high concentrations of the disperse phase necessary.

The difficulty can be overcome by the use of the plastometer. We have then two apparently well-defined properties, viz., yield value and mobility. Colloid solutions at different concentrations fall into two types, plastic and pseudo-plastic, between which there seems to be a sharp distinction, dependent upon the character of the structure of the material. Moreover some colloidal solutions such as glue and nitrocellulose show a definite temperature from plastic solid to true liquid, which is the analogue of the melting point of crystalline substances.

Finally the concentration of disperse phase at which the property of plasticity finally disappears, appears to be well-defined and measurable, and definitely related to the pore space and the volume of the dispersion medium.

The Ferrocyanide Test for Zinc

By R. D. Mullinix and A. L. Stallbaumer

Potassium ferrocyanide precipitates a white zinc ferrocyanide which, when treated with bromine water, turns a characteristic yellow color. No systematic work has been done to determine the best conditions for the test or to compare its sensitiveness with that of the hydrogen sulphide test. Such work has been done by the authors and leads to the following conclusions.

1. $K_4Fe(Cn)_6$ test for zinc is ten times as delicate as the H_2S test. 0.1 mg. of zinc ion in 50 c.c. of solution can be detected 1.0 mg. is about the limit for the sulphide method.

2. The test should be carried out in a solution about one-half normal with acetic acid and should contain ammonium salts. Warming to 60 aids flocculation.

3. The ferrocyanides of the alkaline earth metals are too soluble to interfere, other metal ions must be removed.

4. The yellow color with bromine water is also given by cadium ferrocyanide.

The Resilient Energy and Abrasion Resistance of Vulcanized Rubber

By H. W. Greider, Mellon Institute

A study has been made of the effects of several common compounding pigments upon the abraison resistance of vulcanized rubber. It was found that gas black gives the greatest resistance to abrasion, followed by light magnesium carbonate, china clay, zinc oxide, colloidal barium sulphate and lithopone, in the order named. There is found to be a relationship, but not a direct proportionality, between tensile strength and abrasion resistance, for rubber compounded with reinforcing pigments. Resilient energy gives an approximate index of abraison resistance with gas black, magnesium carbonate china clay and zinc oxide, but it is not a measure of abrasion resistance with colloidal barium sulphate or lithopone. The data appears to show that hardness (or rigidity) is also a factor in resistance to abrasive wear. The product of resilient energy and hardness is suggested as an index of toughness.

Some principles are suggested which may be of value in compounding rubber to obtain high resistance to abrasion, including the use of high grade accelerated mixings and combinations of reinforcing pigment in such proportions by volume as to give proper rigidity combined with high resilient energy. Combinations of gas black and magnesium carbonate in suitable proportions are found to give high resistance to abrasion, high resilient energy and considerable hardness and rigidity.

Rubber Softeners

By P. M. Aultman and C. O. North

The action of rubber softeners on rubber itself has received very scant attention from rubber chemists. The writers in an effort to find out this action, heated vulcanized rubber in each of a large number of softeners until total disintegration ensued. The comparative rate of disintegration was also observed by means of a test in which the swelling of the rubber in the softeners was measured. This method was checked roughly. Sulphur, accelerators, and both together, were added successively to the softeners to find out their effect on the action, with the results that in each case there was an increase in the rate of solvation. The state of cure was also found to have an effect on the results, as the rate of solvation was found to be inversely proportional to the cure. Mixtures of softeners were found to have, in many cases, the average properties of their components. From these, and compounding results, the writers are of the opinion that a definite relation can be worked out between solvating action and the effects of softeners on the stress-strain cure.

TIMBER SEASONING PROCESS

An invention by M. Otto, Professor at the Sorbonne, for a process for seasoning timber by the use of ozone. The process is said to give the same result in about twenty days as would naturally be obtained in the course of several years. The wood is subjected, under the Otto process, to a current of air containing a certain percentage of ozone. A micrographic examination made by the laboratory of the "Conservatoire des Arts et Metiers" shows that samples of oak and walnut which had been treated by this process show the same characteristics as seasoned wood, the treatment making no change in the color of the wood. The process is being worked by a French company which has constructed works at Seregno, near Milan, and will shortly build new works in the neighborhood of Paris.

The report of the American Cyanamid Co. for the year ended June 30th, reports net sales of $4,303,194, including the sales of the Amalgamated Phosphate Co. This compares with $6,046,649 in the previous year. After all expenses, including taxes, interest and other charges, the net income amounted to $197,992, against $344,110 last year. The profit and loss surplus on June 30th totalled $3,143,276, against $2,291,480 last year.

PEACHES FOR PERFUMERY

The odorous constituents of the peach, according to Messrs. F. B. Power and V. K. Chesnut, may be said to consist chiefly of the linalyl esters of formic, acetic, valeric, and caprylic acids, together with a considerable proportion of acetaldehyde and a very small amount of an aldehyde of higher molecular weight. It is probable that the volatile acids are present to some extent in a free state.

A minute amount of acetaldehyde is contained in the emanation from the entire ripe fruit.

No trace of hydrocyanic acid or benzaldehyde could be detected in the distillate from peach pulp. It may therefore be concluded that the occurrence of the glucoside amygdalin is restricted to the kernels of the fruit, and that no other compound capable of yielding hydrocyanic acid or benzaldehyde is present in the pulp or in the skins.

Extracting a concentrated distillate of the peach with ether, a very small quantity of an essential oil was obtained. This was a pale yellow, limpid liquid, which possessed an exceedingly fragrant and intense peach-like odor. When cooled somewhat below the ordinary temperature, it formed a concrete, transparent mass, interspersed with minute, acidular crystals. These crystals evidently consisted of a paraffin hydrocarbon, which, when indirectly isolated, melted at about 52 deg. The yield of essential oil was 0.00074 per cent. of the weight of pulp employed.

In addition to the esters, the peach oil contained a little acetaldehyde and furfural, the latter having doubtless been produced during the process of distillation by the action of organic acids on the sugar contained in the fruit. The presence of cadinene, or a compound giving a similar color re-action, was also indicated.

The essential oil of peach is a very unstable product. When kept for a comparatively short time in a glass tube with a capillary constriction and only occasionally exposed to the air, it became converted into a black, viscid mass, and had then completely lost its original fragrance. This change is in accordance with the character of the constituents of the oil as determined by the present investigation. If the oil, as first obtained, be brought into a glass tube, and hermetically sealed, it appears to be capable of preservation for an indefinite period.

BLEACHING FOODS WITH SULPHUROUS ACID

Sulphur dioxide has always been considered effective in bleaching foods, but those manufacturers who use this bleaching agent have had great difficulty in removing all traces of the bleach after its work was done. The Government prescribes that food bleached in this way must contain no trace of sulphur. A process has now been patented which enables the manufacturer to use sulphur fumes for this purpose without encountering any difficulty in their subsequent removal. After the bleaching action is finished, enough hydrogen peroxide is added to remove all traces of sulphur dioxide still left in the food. This process can be applied with good results to the bleaching of cherries, gelatine, fruits, syrups, nuts, potatoes, apples and cereals. —From "The Industrial Digest."

REMOVING INK FROM OLD PAPERS

A process has been developed by the United States forest products laboratory at Madison, Wis. According to Reuter, one mill, under commercial conditions, removed ink from 1,500 tons of old newspapers, and re-made the paper into newsprint stock of desired strength and color, which was accepted by publishers as standard. Bentonite, a claylike substance formed from volcanic ash, and found largely in Wyoming, is used in the process. It dissolves the ink and leaves the paper clear. It is believed that much of the 2,200,000 tons of newsprint annually used can be salvaged.

The Eighth National Exposition of Chemical Industries

WE have endeavored to bring back to Canadian readers each year an impression of this spectacle of chemical achievement in the United States. It is obviously so great an event and offers such a remarkable cross-section view of type equipment, chemicals and apparatus, that its value to the individual can hardly be over estimated. There are minor changes apparent from year to year, and, from some viewpoints, the exposition this year did not attain the peak of enthusiasm that had been reached under former and more extravagant business conditions.

The Exposition has suffered for the time being some of the deflation common to general conditions, due to the withdrawal of a very few exhibitors, but for the visitor with real business and sound educational pleasures in mind, there remains more than enough to occupy the week, and there must be few indeed who come away feeling that they have really seen the whole show.

Bringing the show back to Grand Central Palace was a good move, although the disadvantages of this type of building become rather apparent, from the standpoint of exhibitors, at least when the crowd becomes great. The exhibitors numbered well over three hundred. The number of visitors from points outside New York was apparently less than usual, due, no doubt, to the cuts placed on travelling expenses, by some companies, and the fact that a larger number of chemists have not had regular employment. It does not require a crowd to make such an exposition a success, and those in charge of many exhibits were as busy as they would wish, demonstrating their equipment to visitors, who were really interested and quite often possible buyers.

The future of the exposition is a matter receiving considerable discussion by exhibitors, and some difficulty will always be faced in arranging an exposition for companies whose interests are slightly more divergent than those of some other national organizations. Chemistry covers everything, influences everything, but chemists and companies employing chemists have very distinct requirements in the supplies they buy, and no matter how important the exposition may be, from the standpoint of national education and publicity, it is essential to its continued success that it be of direct financial benefit to each exhibitor. We are not exactly in an era of philanthropic business activities.

A visitor entering the show would see on the first floor most of the large machinery and process exhibits in operation. Here the standard equipment of well-known firms is displayed, and the latest methods of filtration, evaporation, grinding, handling chemical solutions, etc., may be studied. On the second and remaining floors of exhibits, were located a great variety of displays, covering industrial and laboratory chemical supplies, containers, pumps, metals and alloy products, books, government exhibits and specialty equipment of all types, such as are now more or less familiar to readers of chemical trade papers through the advertisements carried.

During the week, a very lengthy program of pictures and addresses was presented. Dr. C. H. Herty presented the opening address, dwelling upon some timely features of the industrial situation from the chemical standpoint. Secretary of Commerce Hoover addressed the salesmen's Association of the Chemical Industries on Tuesday evening, dealing with the coal situation. Each day, certain allied groups of industries met, such as the Synthetic Organic Chemical Manufacturers' Association. The Technical Association of the Pulp & Paper Industry met on Wednesday and the Photographic and Microscopal Society on Wednesday. Friday was Ceramic day. All these papers and addresses were filled with information and stimulation for the representatives of the industry who attended in large numbers.

The casual visitor may feel that there is more than he can cover, but the chemist or business man who wishes to select his own program will find something of value for him in the great mass of exhibits, papers, pictures and ideas presented.

The exposition perhaps in a gradually modified form has come to stay, and, if it cannot be made the occasion of an annual visit, should be put down as part of the complete education of every chemist in America, and all interested in Chemistry as it affects business and manufacturing operations.

For Canadians, it is interesting to see Canadian exhibits and hear the general remarks of those making inquiries about Canada. Such publicity on the part of Government Departments or individual companies is extremely valuable. Perhaps another year the Dominion Government may be represented in a larger way. Our resources are worth the effort to display them, and by specializing a little more on processing and possible products of manufacture, rather than raw ore, timber or potential power, a more clearly defined vision of the possibilities of Canada as a place in which to establish manufacturing operations might be secured.

ADDRESS AT OPENING OF THE EIGHTH NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, NEW YORK, SEPTEMBER 11, 1922

By Charles H. Herty, Chairman of Advisory Committee

FOR the eighth successive year, the National Exposition of Chemical Industries is hereby formally opened.

This is truly a "pandemic" exposition, if I may use the term which Professor Bancroft, of Cornell, has recently brought into useful work from a generally overlooked chapter in the dictionary, for the Exposition serves not only the purpose of the chemist and the chemical manufacturer, in bringing together the latest developments in the chemical industry, but it also serves the broader purpose of public understanding and appreciation of the marvellous possibilities of chemistry, and its application for the good of humanity.

The chemical industry, being essentially a key industry, can truly be regarded as a barometer of general trade conditions. Its products are used chiefly by other industries, rather than directly by the consumers, so when business stagnation begins to set in, our industry is the first to feel the pinch; fortunately, the converse is true, for with the revival of business, our industry is the first to get the benefit. Present indications from all quarters, point clearly to the fact that this period of depression is passing, and I look forward with confidence to a steady advance in the early future to unexampled activity.

Among the causes which have contributed to recent decreased activity, and entirely outside of the general domestic trade situation, has been a marked decrease in export trade in a number of lines, particularly the synthetic organic chemicals such as dyes, drugs, etc. The statistics of the Department of Commerce, show all too plainly that our manufacturers of these products have not been able to compete in foreign markets with the Germans, and this fact attests to the correctness of the solicitude which many feel for the domestic market, unless thorough-going measures of protection are adopted by Congress.

Unfortunately, the stagnant period through which we have just been passing has already reflected itself in our educational institutions where the intense spirit of enthusiasm for chemistry prevailing amongst students a few years ago has been distinctly chilled. This situation will, I believe, soon correct itself.

Another misfortune of this retrenchment period has been the tendency on the part of many of our industrialists to curtail at the very outset their research staffs. As a nation, we have not yet grasped, except in a superficial way, the fundamental necessity for intensive research, if America is to lead in constructive industrial development. I cite these difficulties, not in any mood of pessimism nor of reproach, but in the hope that at this time of annual review of progress, we may not cultivate any false illusions.

Within the industry, organization for mutual aid has proceeded apace. The manufacturers of chemical equipment, whose exhibits constitute so striking a portion of this Exposition, and who, for a long time, have been an unorganized unit, have now completed the formation of a vigorous trade association, known as the Chemical Equipment Manufacturers' Association, wherein problems common to all may be effectively solved. So too, in the field of organic chemistry, the organization hitherto confined to the group of dye manufacturers has been extended to include all lines of synthetic organic chemistry,—medicinals, perfumes, photographic re-agents, tanning materials, flavors etc. The latest child of organization is the Technical Photographic and Microscopical Society, which has arranged a striking program to be given in connection with this Exposition.

Difficulties Met by Manufacturers of Synthetic Organic Chemicals

While the longer established lines of chemical industry, such as the heavy chemicals and electrochemicals, have at least held their own in quiet waiting for business revival, it has been a far different story with that youngest member of the family,—the synthetic organic chemical. For a full year, it has had to bear the brunt of intensive persecution from those high in Government position, and from whom it had a natural right to expect, instead, general support. The first phase of this was the investigation by the Sub-Committee of the Judiciary Committee of the United States Senate. The industry, however, gladly welcomes this as affording a means for disposing of the silly charges of monopoly, unfair practices, and illegal methods of affecting public opinion; and it is gratifying to note that the chairman of that committee of the Senate, Hon. Samuel M. Shortridge, of California, after five months spent in hearing evidence under oath, pointed out clearly the false character of the allegations made against the industry, and that the other member of the committee, Senator Sterling of South Dakota, paid glowing tribute to the industry in the debate in the Senate.

Next followed anxiety and uncertainty as to the recommendations of the Finance Committee of the Senate in the pending Tariff Bill. Press reports of this morning indicated that the opponents of the American industry are still actively at work, seeking to demolish it. In a short while we shall know the result, and be then in a position to know whether America desires to hold fast to that which it has, or again submit itself to foreign domination.

But it is not alone from the halls of Congress that our troubles have come. One of the great departments of administration, the Department of Justice, has instituted suit for the recovery by the Government of patents sold to the Chemical Foundation Inc. by the previous administration. It is an astounding situation that this branch of our Government should seek to stigmatize the individuals, firms, corporations and associations in this industry as conspirators, as practisers of deceit. This charge will not stand up in the courts, where it now must be sifted, and I am confident that it will be eventually held up in scorn against those who have wilfully sought to add to the burdens of those who seek to serve this country.

From the same high quarters, come accusations that the officers of the Chemical Foundation Inc. were seeking private gain under the guise of public beneficence, and yet records clearly show, and have shown for more than three years, that under the licensing system as practised by the Chemical Foundation, no American has any right that is not open to all good citizens of this country,—and I desire here to pay public tribute to the unselfish spirit and the untiring zeal of the president of the Chemical Foundation, Mr. Francis P. Garvan, in the great work which he has done to prevent this country ever again being situated as it was in this important industry, at the outbreak of the war.

I cannot conclude with this unpleasant side of the picture, but prefer to turn to the pages of the "**Congressional Record**" of August 17th and 18th, 1922, and to point out to you the estimate placed upon the synthetic organic chemical industry by senators representative of all sections of our country, and of both political parties, as set forth in their own words in recent debate in the Senate:

> SENATOR LODGE—"I voted for it for the sole reason that I wished the country to be independent in the matter of organic chemistry. No matter what it may cost, it is something that is worth any price they choose to pay to make the country independent in that direction."
>
> SENATOR WADSWORTH—"I believe that in organic chemistry lies the solution of the secrets of the past and of the future."
>
> SENATOR RANSDELL—"We must bear in mind how necessary it is to establish and maintain a strong chemical industry in America, how essential this industry is for our welfare, our national defense, and, in a more important way, our public health."
>
> SENATOR STERLING—"It has done so much within the short time it has been in existence since the beginning of the war, produced so much of wealth for the United States, given employment to so many thousand workmen, skilled and unskilled, in the United States, it seems to me that as American citizens, with pride in our industrial development, we should maintain and encourage it in the highest possible degree."
>
> SENATOR FRELINGHUYSEN—"When we realize that the next war will be fought with chemicals, I think it is our patriotic duty to give this industry the highest protection that can be imposed."
>
> SENATOR JONES, New Mexico—"Here is an amendment which I think concerns a so-called key industry; I think it is an industry which is essential for the welfare of the country."
>
> SENATOR BURSUM—"American blood was shed on foreign soil to save the world, and if we are to allow this industry now to perish, that shedding of blood will have been in vain."

In the light of these splendid statements, should the present Congress adopt in the pending tariff bill unquestionably adequate protection for this industry, there will be placed upon us the gravest responsibility to meet that trust worthily, and to that end, we pledge in advance the very best that is in us.

EUROPEAN NON-FERROUS METAL MARKETS OPEN TO CANADA

Dr. Charles Camsell, Deputy Minister of Mines, Ottawa, after visiting all the leading markets of Great Britain and the continent, is convinced that Canada can replace in Europe the markets now closed to the United States by the revised tariff, especially for such minerals as graphite, mica, feldspar and talc. Dr. Camsell ascertained what European buyers require, and what they are prepared to pay, and it is now entirely up to Canadian producers to get together and make plans to secure this business. Dr. Camsell states that the Imperial Mineral Resources Bureau, London, will assist Canadian producers in the furtherance of their plans.

NEW SCIENCE BUILDING FOR WESTERN UNIVERSITY

Construction work on the first of a group of new buildings for the Western University, London, Ont., which will ultimately cost $5,000,000 will be commenced shortly. The contract for the new science building to cost approximately $500,000, has already been awarded.

Chemical Society News

Containing Official Announcements of the Canadian Institute of Chemistry.

REPORT OF COUNCIL MEETING, CANADIAN INSTITUTE OF CHEMISTRY

The president, Dr. J. S. Bates, and the secretary, L. E. Westman, were present at the annual meeting of the Maritime Chemists' Association, held at Halifax. They were able to extend an invitation to all qualified chemists to join in Dominion-wide organization work, and found the members in Nova Scotia and New Brunswick prepared for this step. As a result, an application for the formation of a Maritime Branch was prepared and has already met with the approval of Council. Practically all qualified chemists in these provinces have signified their written intention of joining the Institute.

Meeting of Council

On September 20th, the second meeting of Council was held at Montreal, when members spent the entire day attending to regular business and planning for future activities. Members of Council present were: Prof. E. G. R. Ardagh, treasurer; Dr. J. S. Bates, president; Dr. A. T. Charron; H. J. Roast; Dr. R. F. Ruttan; Prof. W. Lash-Miller; Prof. A. C. Neish; and L. E. Westman, secretary.

Among the important motions passed and reports received were the following:—

COMMITTEE REPORTS:—

Interim report of the Secretary, outlining correspondence activities of the office. Interim report of the Treasurer, indicating receipts and expenditures from May 17th to date, and suggesting a possible deficit over the activities of the calendar year 1922. This must be met in future by arranging to undertake only absolutely necessary expenditures.

Legislation Committee: Chairman H. J. Roast made a report of progress, stating that the main activities of the committee were a revision of the by-laws, and the preparation of a model bill for the use of chemists in any Province where legislation might be sought. He felt confident that the work of the Committee would be in complete shape for presentation well before the next annual meeting.

Publicity Committee: Mr. W. C. Lodge, the Chairman, reported in person and explained the necessity for a grant for this purpose. Council decided against any expenditure along this line for the present time. As a result of the discussion, it is possible that individual members of the Institute will create a prize fund for the best article submitted by members in Canada and accepted by a Canadian national magazine or business paper.

A motion was presented and carried, urging all members of the Institute to address such organizations as Rotary, Kiwanis, Boards of Trade, Boy Scouts, Girl Guides, Canadian Clubs, Fraternal Societies, as opportunity presented, upon subjects of general interest, designed to stimulate their interest in, and knowledge of the work of chemists.

International Chemical Union: The committee recommended to Council that the Institute maintain its connection with the International Chemical Union and pay the annual fee (1,000 francs) from the funds of the Institute. To date, delegates have been sent at no cost to the Institute.

Employment Committee: This Committee introduced a motion, which was carried, to restrict its activities to members, including students. At present a large number of applications are received from non-members in the United States and Canada, that cannot possibly be handled by the Institute. Manufacturers and Government departments are beginning to bring to the attention of the Bureau such vacancies as exist and the field of co-operation along this line seems promising.

Committee on Policy: Dr. Bates announced the formation of this Committee, consisting of vice-president and officers of the Institute, and stated that it was considering reports on policy, made by similar organizations and was designed to define as clearly as possible the immediate and general aims of Institute work.

MOTIONS ADOPTED

1. That $300 be set aside for Council meetings and that it be understood that the transportation of one member of Council from some province other than Ontario and Quebec be undertaken for one Council meeting during the year.

2. Recommendation that the fiscal year end May 1st, instead of December 31st.

3. Detailed stenographic report of Annual Meeting to be discontinued.

4. Application of members in Maritime provinces to form branch accepted.

5. Recommendation sent to Legislation Committee to create new class of local members. In this way, those without full qualifications for membership might join with local sections in meetings. Any nominal fee would be retained by the Section, but no voting or office holding power would be vested in such membership.

6. Recommendation sent to Legislation Committee to revise By-Laws so as to call for organization on a provincial basis. In this connection, a motion was passed, stating that in the opinion of Council, it was desirable that members of Council from various districts should, as soon as possible, call organization meetings of members in their district, with a view to the formation of Provincial branches and sections thereof, where desirable.

7. Provision was made for individual annual membership cards.

8. The office furniture of the Institute in Montreal, with the exception of essentials, such as typewriter and addressograph, will be sold immediately.

The Secretary will continue to send out detailed reports privately to all members.

The Council of the Institute desires to express the hope that all members will enter into Institute activities with a full conception of the pioneer work being done, its magnitude and importance. If the same unstinted interest, support and patience is given to the problems of professional advancement, that are so readily secured for social activities along other lines, undoubted benefits will accrue to the profession in Canada, and an organization may be built up, which will act as a model for similar activities abroad. It is with the full realization that chemists elsewhere are exceedingly interested in the progress the profession is making in Canada, the Council desires and requires the continued active support of all members. A large proportion of the membership has been "standing easy," while a small minority has been struggling with the problems of organization work, but the institute is now entering upon an era where there will be every opportunity for local activity and effort. This should quicken our development and do much to broaden our sphere of influence among chemists internationally other professions within the Dominion, and the industries and public we serve.

To have a useful directing influence in the economic development of Canadian resources is an ambition worthy of skilled workmen in the fields of the chemical and allied sciences.

L. E. WESTMAN, Secretary.

NEW MEMBERS OF INSTITUTE

FELLOWS (F.C.I.C.)

Professor D. U. Hill, Department of Chemistry, Acadia University, Wolfville, N.S.
George A. MacPherson, 134 Crescent St., Sydney, N.S.
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ASSOCIATES (A.C.I.C.)

Gordon B. Leitch, Provincial Laboratory, Regina, Sask.
Walter A. S. DeLong, Agricultural College, Truro, N.S.

STUDENTS

William K. Murray, Y.M.C.A., Barrington St., Halifax, N.S.
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OBITUARY

Dr. Henry Larouche, F.C.I.C.

Dr. Henry Larouche, Director of the Civic Laboratory of Montreal, died suddenly on August 16th, following an operation for appendicitis. He had been director of the city laboratory since 1919, and at the time of his death was only thirty-three years of age. He graduated with honors in 1913 from Laval University, and entered the Hotel Dieu where he began extensive research work along bacteriological lines. He was especially interested in a series of researches in the Wassermann test and in the Ambard constancy, the results of which were communicated to the Montreal Medical Society.

As assistant to Dr. Baril at the Hotel Dieu, Dr. Larouche took up the course of Public Hygiene at the University de Montreal. On graduation as a Doctor of Public Health in 1917, he was named a demonstrator in the faculty of medicine and made assistant professor to Dr. Baril in the Department of Chemistry.

In 1919, following the death of Dr. Henri Saint George, director of the Civic Laboratory, he was given the post, usually occupied by a much older man. As civic analyst he filled the position with ability, and at the same time remained an officer of instruction at the university and also carried on his researches.

Dr. Larouche always had a great interest in the science of chemistry and was a Fellow of the Canadian Institute of Chemistry.

He is survived by his widow, whom he married seven months ago; by his father, Alfred Larouche, 16 St. Germain street, and by several brothers and sisters.

The funeral took place from his late residence, 1780 St. Catherine St. E. to Hochelaga Church, and was largely attended.

ANNUAL "SCHOOL" RE-UNION

The Fourth Annual Meeting of the Engineering Alumni of the University of Toronto, known around Varsity as the "School Re-union" will take place, Friday and Saturday, October 27th and 28th. These meetings constitute an opportunity to renew old friendships and to revive old college memories. On Friday, October 27th, class luncheons will be held at noon, and in the evening a dinner dance will be held at the King Edward Hotel. On Saturday the 28th, the annual meeting of the Alumni will be held, followed by a buffet luncheon, while the afternoon will be given over to a football game between Queen's and Varsity. The re-union will be closed with the annual dinner in the evening. The officers of the Alumni for the current year are: President, Walter J. Francis, '93, Montreal; Vice-Presidents, W. A. Bucke, '94, Toronto; J. B. Challies, '03, Ottawa; R. J. Marshall, '08, Toronto; Treasurer, W. E. Douglas, '02, Toronto; Secretary, C. E. MacDonald, '18, 906 Bank of Hamilton Bldg., Toronto.

MEETING OF REFRIGERATION ENGINEERS

The thirteenth annual convention and exhibition of the National Association of Refrigerating Engineers will be held at the Planters Hotel, St. Louis, November 1st to 4th. A registration of five hundred is anticipated. Appropriate papers will be read and discussed, and an opportunity presented to study latest methods of practice and development. The objects of the Association are professional and entirely educational. Canadian engineers interested in such problems should find attendance well worth while.

NEW BOOKS

"THE CHEMISTRY & TECHNOLOGY OF GELATIN & GLUE"

By Robert H. Bogue. 640 pp. McGraw-Hill Co., New York.

The publication of such a book in itself is significant of our progress. Memories of R. K. Duncan and others arise, when it is observed that this book belongs to the Mellon Institute Technochemical Series. The trail leads through an amazing amount of brilliant research work to the point where a very creditable summary of quite definite chemical and technological data can be presented in book form.

The work divides itself naturally into two parts, theoretical and technological, with the chemistry of the subject given first attention. The general constitution of protein, the chemistry of gelatin and its physico-chemical properties and structure are developed in good detail. A considerable amount of recent information is worked in with older data and the whole makes a very complete presentation of our knowledge. Two important chapters are specially devoted to colloid considerations. Here full advantage is taken of our rapidly advancing conceptions iand an almost complete record of work bearing on the subject s discussed by an author very much at home in the field.

The style of presentation and the balanced discussion of all points shows most careful thought and work.

Part Two contains a Chapter by R. C. Shury, on the manufacture of glue and gelatin, that is certain to be well received by all in the business. His experience with the Armour Glue Works makes his observations of special value. One chapter deals particularly with water-resistant glues and glues of marine origin. Glue testing and chemical analysis are treated fully, as well as the evolution of glue and gelatin. This portion of the work will make a most useful guide to laboratory and plant control work. The work is completed with chapters on the application of glue and gelatin.

The book gives every indication of being a most reliable presentation of data and is a timely and distinct contribution of a high order to chemical literature. It should stimulate research and a broader general application of science in this field.

CHINESE CHEMISTS ORGANIZE

The American Chemical Society may be the parent of a future "Chinese Chemical Society," according to information from Dr. Robert E. Swain of the Department of Chemistry, Stanford University, California.

At a meeting of Chinese students majoring in Chemistry in the University of California and Stanford University, held at Stanford University some time ago steps were taken to bring together into one organization all of the hundred or more Chinese students engaged in work in chemistry and chemical engineering in the universities of this country, Dr. Swain reports.

The purpose of the organization, as stated in the Constitution, which was adopted, is to bring all Chinese engaged in work in chemistry in America into more intimate relationship professionally and socially; to encourage a wider interest in the study of chemistry by the Chinese students at home and abroad; and to promote a higher appreciation of the place of chemistry in the growth of the Chinese Nation and the advancement of its people. The organization is to be called "The Chinese Students' Chemical Association" and already has thirty or more members in western universities. It is expected that before the beginning of the next academic year the membership will be extended all of the universities of the country.

MARKED INCREASE IN GOLD PRODUCTION FEATURES MINERAL OUTPUT OF ONTARIO FOR FIRST SIX MONTHS, 1922

RETURNS received by the Ontario Department of Mines from the metalliferous mines, smelters and refining works of the Province for the six months ending June 30th, 1922, are tabulated below. For purposes of comparison, the quantities and values are given for the corresponding period in 1921. Tons throughout are net tons of 2,000 pounds.

SUMMARY OF METALLIFEROUS PRODUCTION—FIRST HALF OF 1922

PRODUCT	QUANTITY (6 Mos.)		VALUE $ (6 Mos.)	
	1922	1921	1922	1921
Metallic				
Gold.............. ...ounces	476,338	286,018	9,845,910	5,761,504
Silver................ "	4,774,666	4,277,762	3,273,247	2,552,125
Platinum metals...... "	151	941	9,421	26,317
Copper sulphate.........lbs.	22,553	87,382	1,310	3,495
Copper, metallic........ "	495,899	2,297,732	57,603	272,132
Copper in matte exported*tons	505	344	101,000	55,040
Nickel in matte exported* "	425	814	212,500	407,000
Iron ore**.............. "	1,004	22	14,472	99
Iron, pig**............ "	10,517	27,147	258,953	733,568
Iron Arsenate........ lbs.	75,000	.....	938	......
Cobalt, metallic......... "	2,411	30,423	7,246	91,355
Cobalt oxide............ "	153,510	99,533	315,284	204,853
Nickel oxide............ "	437,258	331,078	75,002	65,652
Nickel—Cobalt oxides, (unseparated).......... "	c. 647,254	26,592	c. 131,525	29,720
Nickel, metallic......... "	102,200	3,121,773	29,466	1,071,479
Other Nickel Compounds. "	27,270	111,279	2,231	9,991
Lead, pig.............. "	1,993,880	1,504,830	112,604	79,322
TOTAL................	....	....	14,448,312	11,363,652

* Copper in matte was valued at 8 cents per pound in 1921 and 10 cents in 1922, while nickel in matte was valued at 25 cents per pound for both years.

** Iron ore figures include only exported product or ore shipped to points other than Ontario blast furnaces. Total output of pig iron was 178,863 tons worth $4,403,977.

Figures in the table represent proportional output and value of product from Ontario ore.

c. Includes residues marketed.

Gold

Gold production for the first half of 1922 shows a marked increase over any similar period and gives promise of an output exceeding $20,000,000 for the full year, as compared with $14,624,085 in 1921.

Porcupine, Kirkland Lake and newer gold areas are attracting the attention of the mining and investing public not only in Canada, but throughout America and Great Britain. The Hollinger Consolidated has established its reputation as one of the greatest gold mines of the world. At present, the milling capacity is 4,300 tons daily. When additional hydro-electric power is available, the ore treated will be increased from 4,300 to 7,000 tons daily. The McIntyre mine has increased its milling capacity 500 tons per day, beginning this month, and is sinking the central shaft to a depth of 2,500 feet. The Dome shaft has been stopped temporarily at a depth of 1,634 feet, and a crusher station is being placed on the 12th level (1,450 feet). Producing mines at Porcupine and Kirkland Lake have a combined daily milling capacity at present of 7,000 tons approximately.

For 1921, the exchange premium averaged 11.61 per cent. By the end of August, 1922, Canada's currency had reached par. The exchange really amounted to a bonus for the gold mining industry. Canada is the first combatant country suffering currency depreciation as a result of the Great War to get back to normal.

Silver

Silver production shows an increase over the corresponding period in 1921. Since the end of June, the McKinley-Darragh and Dominion Reduction Company have been operating their mills. South Lorrain is attracting attention owing to the satisfactory developments on the Keeley and Frontier properties. Some very fine show samples of leaf silver have been found recently on the Frontier. The Castle mine at Gowganda is also meeting with encouraging results.

The average New York price for the period was 67.34 cents per ounce as compared with 59.9 cents in 1921, and $1.17 in 1920. Shipments over the T. & N. O. Railway from Cobalt, of ore and concentrates totalled 474 tons to Ontario and 385 tons to points in the United States. Mines shipping over 200,000 ounces are given in order: Nipissing, 2,167,265; Mining Corporation of Canada, 701,891; Coniagas, 647,544; O'Brien, 539,768; Keeley, 298,806; La Rose, 244,224. A summary of output is given hereunder:

	Ounces	Value $
Shipments from Cobalt, South Lorrain and Gowganda..................	4,697,335	3,219,326
Recovery from gold ores..........	76,405	53,284
Recovery from nickel-copper refining ...	926	637
	4,774,656	3,273,247

Refineries: The Coniagas plant at Thorold has been overhauled, the process changed and the company re-organized under the name of The Coniagas Alkali and Reduction Company, Limited. The new company did not receive any shipments for treatment during the period, but marketed materials on hand. No residues were received by Southern Ontario smelters during the half year, but subsequently, owing to reduced freight rates, shipments have been made both to Thorold and to the Deloro Smelting and Refining Company, Limited, at Deloro. Ontario Smelters and Refiners, Limited, with plant at Welland went into the receivership of the Trusts and Guarantee Company of Toronto on May 30th.

Nickel-Copper

Owing to the continued overstocked condition of the copper and nickel markets, mining, smelting and refining operations have been greatly curtailed. The Mond Nickel Company was the only smelter operated, treating 93,148 tons of ore and producing 4,535 tons of nickel-copper matte, the two other smelters remaining closed. The International Nickel Company of Canada re-opened its Port Colborne refinery on May 1st and treated 1,269 tons of matte. Nickel-copper matte on hand at Bayonne, N.J. (1,094 tons) was re-shipped to Port Colborne, where all refining operations will be conducted hereafter. The Bayonne plant has been scrapped, and some of the equipment shipped to Port Colborne. During the dull period, new uses, and new markets have been found for nickel, and as a result, the Copper Cliff smelter was re-started on September 1st, two converters being placed in commission. The Creighton mine was re-opened a week previously. All mining and smelting operations by this company were suspended in August, 1921. The average price of electrolytic copper for the period was 13.02 cents per pound.

Iron Ore and Pig Iron

Moose Mountain, Limited, shipped beneficiated magnetite in the form of briquettes to Electro-Metals, Limited at Welland, makers of ferro-silicon.

Only three iron furnaces were in blast during the period, two operated by the Algoma Steel Corporation and one by the Steel Company of Canada. Of a total of 337,637 tons of ore smelted only 19,843 tons or 5.88 per cent. was of Ontario origin. In addition to the pig iron product mentioned in the table 164,616 tons of steel, worth $5,567,256 were produced.

Lead

Ontario's only operating lead mine and smelter, situated at Galetta on the Ottawa River, are operated by the Kingdon Mining, Smelting and Manufacturing Company. The recovery noted in the table was made from 22,770 tons of ore. A blast furnace is being installed to treat the slag and flue dust which have accumulated from the Scotch hearth. A small recovery of lead is made from Cobalt silver ores by certain refineries in the United States, returns of which are received at the end of the calendar year. The average New York price of lead for the half year was 5.07 cents per pound.

PRODUCTION OF NON-METALLICS AND STRUCTURAL MATERIALS

PRODUCT	QUANTITY		VALUE $	
	Year 1921	First Half 1922	Year 1921	First Half 1922
Non-Metallic				
Apatite................tons	......	31	......	248
Actinolite.............. "	78	......	975	......
Arsenic, crude and white..lbs.	2,982,525	2,438,731	233,763	163,318
Corundum.............tons	402	......	50,250	......
Feldspar.............. "	15,506	5,676	114,059	45,205
Fluorspar.............. "	115	123	1,744	1,486
Graphite.............. "	363	330	23,273	17,032
Gypsum.............. "	84,765	44,932	433,053	260,670
Iron Pyrites............ "	19,375	5,846	91,604	20,486
Mica.............. "	222	215	29,630	17,076
Mineral Water.......... "	......	......	9,000	2,965
Natural Gas.......M. Cu. ft.	8,532,234	3,863,000	2,975,502	1,638,400
Peat...................tons	500	1,860	2,000	9,300
Petroleum.............bbls.	172,859	76,003	466,716	218,888
Quartz.................tons	12,957	6,957	74,635	9,843
Salt.............. "	149,599	87,775	1,509,287	926,938
Talc.............. "	9,967	6,706	140,390	86,472
TOTAL..................	....	....	6,155,984	3,418,327
Structural Materials				
Clay Products—brick, tile, pottery, sewer pipe........	....	....	3,885,199	* 2,758,500
Cement (Portland)......bbls.	2,723,072	....	6,425,266	4,062,000
Lime..................bush.	2,610,129	....	1,172,680	832,500
Sand and Gravel.....cu. yds.	1,412,956	....	668,098	474,500
Sand-lime brick..........M.	....	....	456,700	324,500
Stone..................	....	....	1,812,863	1,287,000
TOTAL..................	....	....	14,420,806	9,739,000
GRAND TOTAL........	....	....	20,576,790	13,157,327

* Estimated.

Non-Metallic Minerals

Heretofore data has been compiled annually for non-metallic minerals, hence the returns of output for the first six months of 1922 cannot be compared with a similar period in 1921, and for that reason, the figures for the full year 1921 are given. It will be noted that in 1922, arsenic, graphite, gypsum, mica, peat, salt and talc show an increase in output over half the total figures for 1921. Arsenic is in good demand and an insecticide plant is in operation at Deloro to use part of the product there, recovered from the refining of silver-cobalt-nickel arsenides. There is little activity in mica mining, except in scrap mica, the prices for thumb-trimmed not being sufficiently high for profitable operation.

Structural Materials

No statistics were received from producers, the estimate being based on the relative activity in construction in 25 Ontario cities as revealed by a comparison of the value of building permits issued for corresponding half-yearly periods in 1921 and 1922. The figures respectively are $24,421,333 and $34,685,905 or an increase in value of 42 per cent. in 1922.---From report of Ontario Department of Mines, W. R. Rogers, Statistician.

CANADIAN FLUORSPAR MAY BE IN DEMAND AGAIN

Mr. R. B. Ladoo, of the United States Bureau of Mines, aftes an examination of the fluorspar deposits of Southern Illinoi and Western Kentucky, reports that, unless new deposits o fluorspar are found, there will be a decided shortage of the mineral within a few years, the present known reserves being of small dimensions. During the war, fluorspar from the Madoc, Ontario, district had a ready market, but lately has not been able to compete with the imported mineral. The findings of Mr. Ladoo should be of considerable interest to Canadian fluorspar operators.

World Conditions and News in Chemical Fields

(Special Correspondence to Canadian Chemistry and Mettallurgy by our London Representative)

British Chemical Market

Business in the heavy chemical market continues to be moderately good, in spite of the holiday season. Increased activity is reported in the textile industry, and this, no doubt, helps the demand for heavy chemicals, but whether there is any permanence in this improvement remains to be seen. Reductions in prices of soda products have been made by the British manufacturers to the home trade. Caustic soda is now obtainable at £20 5s. for the 70-72 quality. Soda crystals have been reduced to £5 15s., and soda bicarbonate to £10 10s. per ton, in bags, carriage paid.

Perhaps the most interesting features of the market just now are arsenic and zinc compounds. The increased demand for the former is fully maintained and prices remain very firm. An appreciable rise in the price of spelter during the last few weeks, combined with a larger demand and depleted stocks, has caused an advance in the price of zinc oxide and other zinc products, and the market is expected to be very firm for some time to come.

Trade in Dyes Improving

Business in aniline dyes is fairly well maintained, and the bulk of the trade is showing gradual improvement.

Increased Iron and Steel Production Dependent on More Shipbuilding

The shipbuilding and marine engineering industries of Great Britain take normally, about thirty per cent. of all the steel consumed, and until there is a renewal in shipbuilding, no great progress can be made in the iron and steel industry. The revival in shipbuilding is of course dependent upon a reduction in costs of construction, but even more so upon a revival in shipping. Prices of many materials have already been reduced and steps are under way to further reduce the labor cost, while freight rates are falling steadily.

Report on Nitric Acid Manufacture

The Department of Scientific and Industrial Research has issued a report on the manufacture of Nitric Acid from Nitre and Sulphuric Acid. The work recorded was done at, or in connection with some of the National factories during the war. Copies may be obtained from H. M. Stationery Office, price by post 11s.

FRANCE

Metal Industry Improving

The situation in the French metal industry is improving, according to the Paris correspondent of the Anglo-South American Bank. A sufficient number of orders has been recieved in the metallurgical industries to keep the works occupied during the quiet season. In the iron ore section, exports to Belgium are increasing while those to Germany remain stationary as a result of the fluctuation of the mark.

French Radium Supply in Madagascar

Attention was recently drawn by M. Karl, when addressing the Industrial Chemistry Congress recently held, to the fact that, while France discovered radium and practically monopolized the article in 1914, the market is now controlled by the United States. The intensive exploitation of the Colorado deposits supplies the American factories first and then the French. Carnotite is, of course, very dear, and there is little advantage in extracting the radium. It pays as well to buy the salts.

But France possesses mineral reserves in Madagascar, much richer than the carnotites of America. M. Karl suggests that the method of extraction should be so modified as to obtain not only the radium, but the associated by-products. He protests that the radium extracted from these minerals is not inferior, as has been suggested. The products prepared with betaphite are free of mesothorium.

Dye Manufacturers Extend Color Range

Statistics of the French Dye Manufacturers' and Consumers' Union, show that of the 10,000 tons of dye products used by France in 1920, as much as 5,739 tons was imported. Consumption fell to 7,000 tons last year, and the quantity imported was only 1,172 tons. The company has devoted much attention during the past twelve months to extending its range of colors, for which most of the necessary plant has been erected. Among the novelties of the season may be noted alizarine oranges and blues, carmine blues, acid violets and greens, rhodomines, Victoria blue, hydro-sulphide and formaldehyde hydrosulphide. Considerable attention has been paid to the manufacture of intermediary products such as naphtylamine and its sulphonated by-products.

GERMANY

German Potato Distillation

According to Professor F. Hayduck, there have been produced from potatoes in Germany this year, 30,000 hectolitres of spirit, for which 2,700,000 doppel-zentner of potatoes were used. The potato harvest for 1921 amounted to 260,000,000 dz., so that only about one per cent. of the annual crop is used in the distilleries. Had the 2,700,000 dz. of potatoes used for distilling, been used for edible purposes, (quite a theoretical assumption, as in this year, only potatoes unfit for human consumption were used by the distilleries), then the current year's ratio per capita would have been increased by 4.5 kg., and the yearly consumption per head would have amounted to 250 kg. From these figures it is seen that the spirit question, as far as it affects the supplies of potatoes, is of no importance as regards food. The difference in the value between the potatoes for food and distilling was thirty-eight against 180-200 marks per zentner.

Prof. Hayduck maintains that, notwithstanding the loss of potato-bearing land in the east, there is enough available surface in Germany to produce 360,000,000 dz. of potatoes, against the 260,000,000 dz. produced last year, the latter being affected by the drought.

SOUTH AFRICA

Asbestos Industry Busy

Every year African competition in asbestos is becoming more and more keen, and now that Russia is no longer a producer, Rhodesia comes second on the list of countries furnishing asbestos. This valuable product is widely distributed in Rhodesia, but the most important fields from the point of view of present output are at Mashaba and Shabani, on the Sabi River. For the last statistical year of which records are available the production was some 9,800 tons.

Throughout the Union of South Africa also there are numerous occurrences of asbestos, and in the Barberton district of the Transvaal there have been extensive developments. The exploiting company, after only six months' work, is said to have 25,000 tons of asbestos rock in sight, and this on an area that is only about one-tenth of the property it holds.

The value of asbestos produced in 1913 in Rhodesia and the Union was £5,224 and £16,028 respectively, whilst the value in 1921 was £795,699 and £103,269.

Rhodesia, which at the outbreak of war had no appreciable asbestos trade, has, therefore, come very rapidly to the fore, while the Union, though not showing anything like the same rapid expansion, has increased her output greatly. Factories for the utilization of this product, which is being put to new uses every year, have already been erected at different places on the coast, and the fact that prices are now recovering from the depression that affected them, bids well for the future of this young industry.

Stamp Battery and Plate Amalgamation Process Abolished by Metallurgical Plants

Experiments have recently been carried out in the Transvaal on a large scale, which have had the effect of demonstrating that extraction can be increased and working costs lowered by the abolition of stamp battery and plate amalgamation operations, in favor of all sliming and direct cyanide treatment. This decision has been arrived at as a result of the treatment of some 4,000 tons of pulp in the experimental plant. The effect of this discovery is of great importance. Probably no such discovery has been made since the cyanide process which made the low grade Rand mines paying propositions. And it cannot fail to have a bearing on gold mines all over the world.

Fertilizer From Tobacco

Johannesburg is to have a new industry with the establishment of a tobacco extract factory, which, it is claimed, will produce a first-rate extract for spraying trees, while the refuse will provide excellent fertilizing material. The promoters of the scheme count on exporting the major portion of their output, and believe that Kentish farmers alone, faced by plant disease of hops and orchards, will take every ounce that the factory can produce.

CEYLON

Shipments of Rubber, 1921

Ceylon's shipments of rubber in 1921 amounted to 90,000,000 pounds, an increase over 1920 of 3,000,000 pounds. These figures reveal a considerable expansion in the rubber industry, as compared with the 15,000,000 pounds and 25,000,000 pounds exported in 1912 and 1913 respectively. A notable feature of the distribution of Ceylon rubber is that in 1921 over 60 per cent. of the exports went to the United States as compared with 44 per cent. in 1920, while the percentage of export to the United Kingdom fell from 51 per cent. to 33 per cent. Germany took 4½ million pounds, as compared with 1 million pounds in 1920.

AMERICAN BRASS COMPANY LOCATES IN CANADA

The Anaconda American Brass Company, Limited, has been incorporated in Canada with a capital of one million dollars for the manufacture of brass, copper and nickel silver products of every variety. The Anaconda American Brass Company, Limited, is a subsidiary of the American Brass Company, which in turn is controlled by the large Anaconda Copper Mining Company, and the newly formed Canadian Company has acquired the business, plant, and good-will of Brown's Copper and Brass Rolling Mills, at New Toronto, Ontario.

The officials of the new Canadian firm are: President, John A. Coe; Vice-President, G. H. Allen, Vice-President of the American Brass Co.; Treasurer, C. F. Hollister, Treasurer of the American Brass Co.; Secretary, M. S. Moss; General Manager, A. H. Quigley. Mr. Quigley was formerly assistant manager at the American Brass Company's plant at Kenosha, Wisconsin, which is the furthest westerly branch of that company. Mr. Moss, secretary and superintendent, comes from the Buffalo branch where he was assistant superintendent.

While the Canadian Charter allows the manufacture of the complete line of products as made by the American Brass Company, for the present only those products formerly made by Brown's Copper and Brass Rolling Mills, will be made. Some articles are finished at New Toronto, but the bulk of the production is of semi-finished materials which are trade-marked. Mr. Quigley is decidedly optimistic regarding the future of Canadian trade in copper and brass products and is of the opinion that the location of the Company here is likely to encourage cutters and brass workers to come to Canada. The research work being undertaken by the Copper and Brass Research Association is said to be doing much helpful work in bringing to the attention of the public the value in using copper and brass products.

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy.)

Smelting Operations

The Granby Consolidated Mining, Smelting & Power Company has turned out only about 12,500,000 pounds of copper during the first half of the present year, but now is pushing output, and, it is expected, will continue to produce close to three million pounds monthly for the remainder of the year, bringing the total for the year to approximately the same as that of last year. The company has made another marked cut in the cost of production, and now is turning out blister copper at nine and a half cents per pound. When the new reservoir, now under construction, is finished and ample cheap power is available, a further cut of about a cent per pound will be made, and this will bring the cost of production close to that obtaining before the war. Good progress is being made with the new dam, and the increased power should be available before the end of the year. A. Cole, of El Paso, Texas, has been at Anyox, and it is understood that he has been given a contract for the construction of a 1,000-ton concentrator at Anyox.

During the extensions and improvements at its refineries at Trail, the Consolidated Mining & Smelting Company of Canada has been forced to allow some 4,000 tons of lead bullion to accumulate, and, in order to get this out of the way to facilitate future operation, the company has made an arrangement with the Bunker Hill & Sullivan Smelter, at Kellogg, Idaho, to have it refined under a "refining-in-transit" rate of $8 per ton to Portland, Oregon, whence it will be re-shipped to Europe via the Panama Canal. About 75 tons of bullion is being shipped daily to Kellogg.

A cablegram has been received from England, stating that the Imperial Trade Facilities Committee is prepared to guarantee one-third of the bonds of the Coast Range Steel Company, the amount not to exceed four million dollars, provided that it is given first-mortgage bonds and that the whole of the machinery is manufactured in England. The Provincial Government has undertaken to guarantee one-third of the bonds, provided it has an equal lien on the assets of the company with the Trade Facilities Committee and the Dominion Government. The Provincial Legislature will meet next month, when it is likely that these small differences will be adjusted.

Cariboo

The unusually dry season and consequent shortage of water will rob the famous old Cariboo district of what promised to be one of the best outputs of gold it has produced since the armistice. A large quantity of ground has been mined that cannot possibly be washed until next spring. This is to be much regretted, because a good deal of the ground is from high benches, which until this year miners have paid little attention to. The actual value of this ground, consequently, cannot be ascertained until next year. Though the expected rush to this field did not reach the proportions anticipated, a lot of good work has been done, and several competent engineers have expressed the opinion that many of the high benches will be worked profitably in the future.

There has been a revival of interest, too, in lode mining in the neighborhood of Barkerville. Prospectors have been exploring a number of large lodes, ranging from ten to sixty feet in width. Some of these are well mineralized and show gold here and there, but unless the whole lode can be worked as a large low-grade body, the occurrence of the gold appears to be too patchy for profitable operation. A good deal of work was done on a lode of this nature two years ago by a Toronto syndicate, headed by Robert Brice, and more work would have been done had the owners of the property been content to have permitted the delay of a large payment when it became due under the agreement, as the syndicate that had bonded the property felt it was not justified in making the payment without doing further exploration.

Coast Mines

Glenville Collins Engineers, Ltd., of Vancouver, has interested Eastern capital in the Drum Lummon mine, on Hartley Bay, and the mine is being re-opened, after about eighteen months of idleness. A new wharf has been built, and new machinery and supplies are being taken to the mine for an active campaign of development. Mr. Collins stated recently that he expected to be shipping both crude ore and concentrate to the smelter some time in October.

Work on the new 2,500 ton concentrator at the Britannia mine is progressing well, and it is hoped that ore dressing will be re-started early in the new year. Development work has been continued steadily since the old mill was burned, and some important new ore-bodies have been developed. The Britannia Mining & Smelting Company recently paid out some $56,000 in settlement for claims from the families of miners who were lost in the disastrous flood of last October.

Portland Canal Division

Some little excitement was occasioned last month by the announcement that the Premier Gold Mining Company had offered the Selukwe Mining & Finance Company one million dollars, payable over two years, for its interest in British Columbia Silver Mines, Ltd., and that the Selukwe company had asked five millions, payable over four years. The Selukwe owns two-thirds and the Premier one-third in this concern. The offer, it is believed, has had the effect of stimulating interest in the district, and a number of deals have been consummated since. A great deal of prospecting and development is being done in the district, and important discoveries have been reported from the Bear River, Salmon River, and Marmot River areas. Several mines will be shipping on a small scale during the coming winter, and there seems to be little doubt that given adequate transportation facilities, the Portland Canal division would become one of the most important mining districts in Canada.

West Kootenay

R. H. Stewart, formerly general manager for the Consolidated M. & S. Co., and Vancouver associates have bonded the Ruth and Hope mines, at Sandon, and will start at once to develop the properties and bring them to the producing stage. Under different ownerships both properties have shipped a good deal of ore to the Trail smelter from time to time, but the properties never have been developed systematically.

The Rambler-Cariboo is developing well, and has been shipping regularly for some time. It is being operated under lease by W. A. Cameron, who also has a lease on the Molly Gibson mine, and has just brought the mine to the producing stage.

The Silversmith Mines, Ltd., continues to make heavy shipments of lead and zinc concentrates and of crude silver-lead ore.

The California Mining Company closed its Athabasca mill, near Nelson, recently, because the present battery and plates were unsuited to make a good recovery, and heavy losses were being made in the treatment of the ore. A ball-mill and cyanide plant will be added to the present equipment.

Personal

G. S. Rice, of the United States Bureau of Mines, is making an investigation of conditions at the Cassidy colliery, near Nanaimo, for the Granby company. A series of gas blow-outs has seriously interfered with mining coal, as explosives cannot be used.

LONDON, ONT.—The McCormick Manufacturing Co., Ltd., well-known manufacturers of cereal products, have greatly increased their laboratory facilities and have put all processes under chemical control.

CATALOGS RECEIVED

Bristols Pyrometers, Catalog No. 1401, recently issued by The Bristol Company, Waterbury, Conn., is a useful industrial compilation that every plant chemist would be well advised to have on hand. Automatic controls are coming, more and more into prominence in well-organized industries, hence superintendents and chemists particularly should familiarize themselves with the various applications of these instruments. High and low resistance pyrometers are fully described and their mechanism illustrated. The Smoked Chart and Moisture-Proof models are particularly interesting, and prices of all models are listed. The charts of the Recording Pyrometers are fully illustrated with examples of charting. A copy of the booklet can be obtained from the head office at Waterbury, Conn., or from the Canadian agents, A. Winter-Joyner & Co., Toronto and Montreal.

ARCHITECTS' SPECIFICATION HAND BOOK

The Truscon Laboratories, Detroit, Mich., have recently issued a hand book especially designed for engineers and architects giving information required for specifying waterproofing dampproofings, oilproofings, floor hardeners and protective finishes. Specifications are given on each page with a description of the particular product mentioned on the back of the sheet. In most cases a list of users of each product is given. The specifications seem to be quite clear and accurate, and the book should prove useful to any chemist or engineer who is called on to recommend or specify protective products.

INDUSTRIAL DEVELOPMENTS

WESTMINSTER, B.C.—Acetate Products Co. are erecting a plant for the carbonizing of Alderwood. The process under consideration is reported to be of the continuous oven type.

HARTVILLE, N.S.—Premier Paper and Power Co. is installing a standard newsprint machine with a capacity of 15,000 tons a year. To provide the necessary power the company is developing an additional 5,000 H.P.

BATHURST, N.B.—The Bathurst Co., Ltd., will shortly commence the manufacture of newsprint, and will erect a plant adjoining their pulp mill. The initial output of the mill will be fifty tons per day, which will later be increased to 100 tons.

THREE RIVERS, QUE.—The St. Maurice Lime Co. are enlarging their plant from two to six kilns, giving the plant a production of 600 tons of lime per week.

DRAGON, QUE.—Operations have resumed at the plant of the Northern Explosives, Limited and it is expected that 5,000,000 lbs. of high explosives will be produced this year. It is the intention of the company to prepare in the near future for the production of permitted explosives, that is, the type used in mines.

WELLAND, ONT.—Welland Cotton Mills, Ltd., recently incorporated with a capital of $1,000,000, will erect a plant for the manufacture of coarse cotton yarns and general cotton knitting trade material.

WELLAND—The Dodds Canadian Iron Works have installed a plant for the manufacture of flour machinery. This will be the Canadian branch of Dodds Bros., of Decatur, Ill.

SHERBROOKE, QUE.—The Manganese and Steel Foundry, Limited, have commenced operations, and are turning out steel castings. The furnace can handle one ton at a heat and three heats are handled per day.

SMITHS FALLS, ONT.—The Manufacturers Chemical Co., an American concern, will operate a plant here for the manufacture of dyes.

REPORTS RECEIVED

Minerals and Mining Industries on The Canadian National Railways

The Industrial and Resources Department of the Canadian National Railways under the direction of Mr. C. Price-Green, Commissioner of the Department, have issued a very interesting and valuable booklet entitled "Minerals and Mining Industries on the Canadian National Railways." The booklet of sixty-four pages was compiled to meet a general demand for information non-technical in character, concerning the mineral deposits on or tributary to the lines of the National System. The purpose of the pamphlet has undoubtedly been obtained; over forty minerals being dealt with, briefly, but at the same time giving the salient points about each deposit that prospective operation or investors would demand. A valuable feature of the report is that the industrial uses of each mineral are outlined.

The importance of the development of Canadian mineral resources to the National Railways is mentioned in the Preface. Mines are a most important factor in contributing to rail tonnage. and the fact should not be overlooked that while agriculture is a basic industry, yet over eighty per cent. of the total area of Canada is unsuitable for agriculture. In this connection we quote the report as follows: "The annual production of the mining industry of Canada has grown from a value of eighteen million dollars in 1870 to over 200 million dollars at the present time and while it can hardly be expected that this ratio of increase will be maintained, there is no doubt that these figures demonstrate the great asset the mineral industry is to the country."

Copies of the report may be obtained from the Industrial and Resources Department of Canadian National Railways, Toronto.

Chemical Oil and Metal Markets

The Quotations Below Represent Manufacturers' and Wholesale Importers' Prices at Toronto, Montreal, or Other Canadian Points.

CHEMICALS

The increased activity noticed on the Canadian Chemical market during August was well maintained throughout September and October opened with prospects of a fairly busy month. The steady increase to business does not appear to be confined to any particular group, but is general throughout the whole market, with possibly the heavier industrial chemicals favored somewhat. The grim spectre of the coal strike has fortunately disappeared, though the effects will more or less be felt all winter by chemical manufacturers. But the real and only obstacle to continued progress, that of a general tie-up of trade by the strike, has been removed, and there would seem no real reason why the chemical business should not continue to improve. Naturally, competition is fairly keen. The day is past when one can sit in his office and expect new business to come uninvited through the door. One result of this competition if one may to-day use such an old and somewhat disfavored word, is that prices are kept at reasonable levels. Some very favorable reductions have been made already this month, but there is no reckless cutting of quotations just to get business. And that is just where strength is given to the market—buyers are given the best price possible, but if somebody dumps a few carloads of material on the market at a "cut-throat" price, he is welcome to get rid of it, and there will be no attempt on the part of the regular houses to meet his price.

The following heavy chemicals have declined the amounts noted during the month, but may now be said to have reached a fairly stable level from which further reductions of any account are unlikely for some time at least:—Alum, 45c. per cwt.; aluminium sulphate, ¼c. per lb.; bleaching powder, ¼c. per lb.; borax, ¼c.; caustic soda, ½c. per lb.; magnesium carbonate, 4c. per lb.; muriatic acid, ¼c. per lb.; nitric acid, ¼c. per lb.; caustic potash, 1 c. per lb.; zinc sulphate, ¼c.; **Advances**—Acetone is stronger and is quoted at 21c. per lb. in drums or over. Both the 28% and 80% grades of acetic acid have advanced an average of ¼c. per lb. on all size shipments, sodium acetate is stronger by ½c. Copper sulphate has advanced 1c. per lb.

Effect of Fordney-McCumber Tariff on Export of Canadian Chemicals

The new Fordney-McCumber Tariff was signed by President Harding on September 21, 1922 and, unfortunately, Canadian products are included in the general tariff wall erected around the United States. Herewith we give the rates of duty per pound, or as stated, now in effect on a number of chemical products entering the United States:—Acetic acid, 65% and less ¾c.; acetic acid, over 65%, 2c.; acetic anhydride, 5c.; arsenic acid, 3c.; white arsenic, free; formic acid, 25%; oxalic acid, 4c.; phosphoric acid, 2c.; acetaldedyhe, 6c. and 30%; acetone 25%; alcohol, amyl, 6c.; ammonium sulphate, ¼c.; argols and wine lees, 5%; bleaching powder, 3 10c.; calcium carbide, $20 per ton; chloroform, 6c.; Cobalt oxide, 20c.; sodium cyanide, free; sodium sulphate, crystals 0.05c.; sodium sulphate, anhydrous, 0.1c.; barytes, crude, $4 per ton: magnesium sulphate, ½c.; fish oils, 20%; linseed oil, 3.3c. per gal.; magnesia, calcined, 3½c.; formaldehyde.2c.; para formaldehyde, 8c.; glycerine, crude, 1c.; glycerine, refined, 2c.; calcium acetate, free; calcium chloride, free; phosphorus, 8c.; prussian blue, 8c.; potato starch, 1¾c.

METALS

Though the coal strike has been terminated, it will probably be near the New Year before the metal industry will be back to normal. At present, steel mills in the United States are working at about 65% of capacity. All steel men are looking forward to a good winter's run on industrial orders, as already construction estimates for next spring are away in advance of last year. Quotations on steel have remained about stationary during the month, but advances are not unlooked for. On the Canadian market, business is exceptionally good on lead, and quotations are firmer. Zinc prices after fluctuating considerably during September, have advanced again during the first week of October and are now stronger by about 40c. per cwt., than at September 1st. Summarized briefly, the present situation in the metal industry is one of readjustment, following the coal strike, and the getting ready for a big year's business during 1923. Every leading authority in the steel, iron, copper and lead industries predicts a successful season for all these metals next year.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

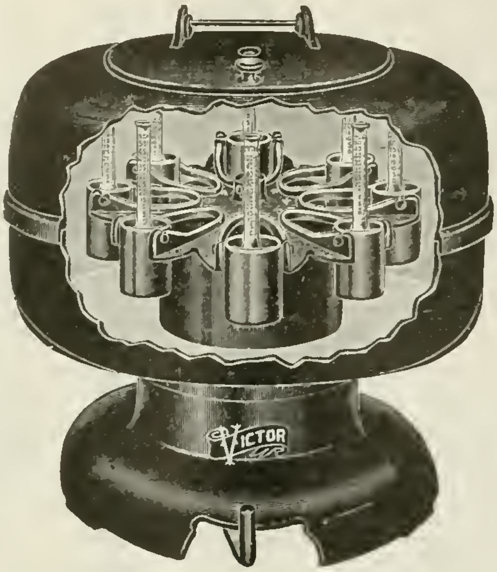
General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.50— 5.00
Ammonium Bromide	Lb.	.. — .22
Aluminum Sulphate, lump, bags	Cwt.	2.25— 2.50
Aluminum Sulphate, ground, bags	Cwt.	2.75— 3.00
Aluminium Sulphate, iron free	Cwt.	.. — 4.00
Ammonia, Aqua, 26, Carboys	Lb.	.. — .14
Ammonia, Aqua, 26, Drums	Lb.	.. —.09½
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb	.. — .14
Barium Sulphate (Barytes)	Pre Ton	30.00—35.00
Barium Chloride	Lb.	.05— .07
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb	.. — .26
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	2.75— 3.00
Borax, crystals	Lb.	.07—.07¼
Boric Acid	Lb.	.. — .13
Bromine (technical)	Lb.	.. — .38
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —95.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	..—100.00
Calcium Chloride, fused	Per Ton	36.00—38.00
Calcium Chloride, flake	Ton	40.00—42.00
Caustic Soda, ground, drum	Cwt.	5.00— 5.50
Caustic Soda, solid, drum	Cwt.	4.50— 5.00
Camphor Monobromate	Lb	.. — 3.00
Carbon Bisulphide, in drums	Lb.	.11— .12
Carbon Tetrachloride, drums	Lb.	.20— .21
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, imported	Per Ton	20.00—25.00
Cobalt Oxide, black	Lb.	.. — 2.00
Cobalt Oxide, grey	Lb.	.. — 2.25
Copperas (Iron Sulphate) crystals	Lb.	.02—.02¼
Copperas (Iron Sulphate) sugar	Lb.	.02—.02¼
Copper Sulphate (Blue Vitriol)	Lb.	.08—.08¼
Corrosive Sublimate (Mercuric Chloride)	Lb.	.. — 1.10
Fluorspar, ground	Tons	.. —30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.11— .12
Ferric Chloride, solution	Lb.	.. — .10
Hydrofluoric Acid, 60%	Lb.	.. — .28
Hydrofluoric Acid, 30%	Lb.	.. — .14
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	.70— .75
Iodine, crude	Lb.	.. — 4.50
Iodine, resublimed	Lb.	.. — 5.25
Iron Oxide (red)	Lb	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.14 — .15
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.09— .10
Lithium Carbonate	Lb.	1.75— 2.10
Lithopone	Lb.	.06— .07
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl	Lb.	.12— .13
Magnesium Sulphate	Lb.	.03½—.04½
Mag. Sulphate, B.P., Medicinal	Single Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Mica, ground, f.o.b. Hull, Que.	Ton	.. —60.00
Muriatic Acid, 18	100 Lbs.	2.25— 2.75
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt.	Lb.	.. —.16½
Nickel Salt, double, barrel lots	Lb	.. — .15
Nickel Salt, double, per cwt.	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lbs.	8.75— 9.00
Phosphoric Acid, 85%	Lb.	.. — .28
Phosphoric Acid, 50%	Lb.	.. — .22
Phosphorus, yellow	Lb.	.. — .34
Potash Prussiate, yellow	Lb.	.28— .30
Potassium Bicarbonate	Lb.	.. — .20
Potassium Bromide, crystals	Lb.	.22— .30
Potassium Bromide, granular	Lb.	.22— .30
Potassium Bichromate	Lb.	.17— .18
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .09
Potassium Chlorate	Lb.	.. — .10
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .45
Potassium Hydroxide (caustic potash) small drums	Lb.	.10— .15
Potassium Hydroxide (caustic potash) large drums	Lb.	.07— .08
Potassium Iodide	Lb	.. — 4.20
Potassium Nitrate, casks	Lb.	.. — .10
Potassium Permanganate, bulk	Lb.	.19— .20
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. — 9.00
Soda Ash, bags	Cwt.	2.25— 2.40
Sodium Acetate, ton lots or over	Lb.	.. — .08
Sodium Acetate, lesser amounts	Lb.	.. —.08½
Sodium Benzoate	Lb.	.75— .80
Sodium Bicarbonate, 100% pure	Lb.	2.50— 3.00
Sodium Bichromate, bbls	Lb.	.10— .13
Sodium Bisulphite, powder	Lb.	.05¼— .06
Sodium Bisulphite, 35 Be	Lb.	.03—.03¼
Sodium Bromide (foreign)	Lb.	.. — .24
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. — .31
Sodium Hyposulphite, kegs	100 Lb.	5.85— 6.00
Sodium Hyposulphite, barrels	Cwt.	5.25— 5.50
Sodium Iodide	Lb.	.. — 4.60
Sodium Nitrate, refined	Cwt.	6.75— 7.00
Sodium Nitrate, crude, 95%	Cwt.	5.00— 5.75
Sodium Nitrite	Lb	.12— .15
Sodium Peroxide, f.o.b. New York	Lb.	.30— .35
Sodium Silicate, 42°, car lots	Cwt.	.. — 1.40
Sodium Silicate, 42°, smaller lots	Cwt.	.. — 1.60
Sodium Silicate, 40°, car lots	Cwt.	.. — 1.30
Sodium Silicate, 40°, smaller lots	Cwt.	.. — 1.50
Sodium Sulphate (Glauber's Salts) crystals,	Per Cwt. in Bags	1.90— 2.00
	Per Cwt. in Car Lots	1.65— 1.70
Sodium Sulphite	Lb.	.. — .05
Sodium Prussiate, Yellow	Lb	.24— .25
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	4.25— 4.75
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars, f.o.b. Toronto,	Ton	23.75—24.00
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Ton	.. —23.00
Tin Chloride crystals	Lb.	.30— .35
Tri-sodium Phosphate	Lb.	.07½— .08
Ultramarine, Blue	Lb.	.15— .35
White Precipitate (Mercuric-Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	.. —30.00
Whiting (American)	Ton	.. —30.00
Zinc Sulphate, com.	Lb.	.04—.04½
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.08½— .10
Zinc Stearerate	Lb.	.25— .30

Organic.

Acetanilid, C. P.	Lb.	.45— .50
Acetic Acid, glacial, carboys, f.o.b. Shawinigan Falls	Lb.	.. —.20½
Acetic Acid, glacial, carboys, car lots, f.o.b. Shawinigan	Lb.	.. —.16½
Acetic Acid, glacial, bbls., car lots, fo.b. Shawinigan.	Lb.	.. — .16



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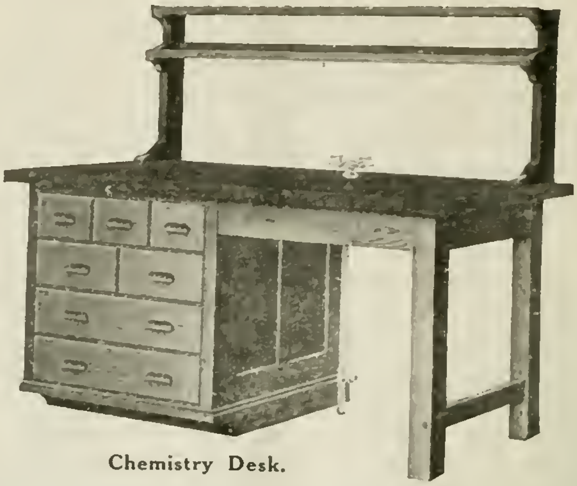

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TABLE OF CONTENTS

EDITORIALS: Page
- Chemical Writers 235
- A Practical Committee 235
- The Side Lines of Research 236
- Insulin 236
- Stolen Ideas 236

The Constitution of Rubber
By Maitland C. Boswell 237

Some Economic Considerations Related to the Manufacture of Dyestuffs in Canada
By C. R. Wright 244

China Clay in Quebec 245

Use of Steam in Coal Gas Retorts 245

Principles of High Temperature Furnace Design
By E. L. Smalley 246

Fields of Paper Research 249

Page.

Chemical Society News:
- Canadian Institute of Chemistry Notes 249
- Toronto Section—Society of Chemical Industry 250

New Books Reviewed 251

World Conditions and News in Chemical Fields 252

Industrial Developments 253

Catalogs Received 253

Chemical and Metallurgical Patents
By A. E. MacRae 254

What Goes Into Automobiles 254

American Pottery Firms Charged With Price Fixing 254

Market Review 255

Market Prices 255

Buyers Guide 43

Index to Advertisers 52

FROM THE PUBLISHERS—

CHEMISTS AS BUSINESS MEN

Chemists as scientists, engineers and specialists in many lines, are well-known; but chemists who have executive ability, training and experience, are not yet so common. A very prominent and successful chemist, who has attained a fair measure of success in business management, took occasion recently to point out how easily men who had such broad, fundamental training, should find the path to larger opportunities.

We believe in definite preparation for such work, by correspondence schools or reading, and, above all, by keeping your eyes open right around you. Follow your results, and when decisions are to be made in things not immediately connected with you, have an opinion based on a logical consideration of all the factors, as you see them. Learn something of general financial operations.

In short, learn to see that your long training in chemistry has given you a mastery of the really hard things to understand and grapple with in connection with many lines of business, and that it should be relatively easy to supplement this knowledge with practical business and financial information. With such a program, there will be no chance to become stale or stationary. You will always be just at the beginning of greater things.

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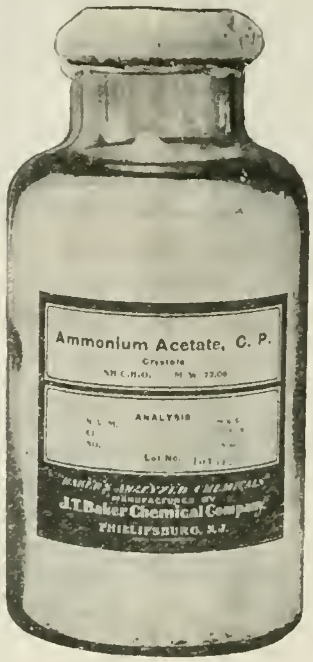

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EDITORIALS

CHEMICAL WRITERS

DR. E. SLOSSON has recently enriched the chemical literature of the world with a plea for "The Human Side of Chemistry." Few are gifted with either his broad knowledge or his power of expression. In short, we can almost count on one hand those chemists in any country who are able to translate the glories of chemical progress in language suitable to the taste and mentality of average readers. We may well ask why people are more interested in astronomy than they are in chemistry. The taking of some eclipse pictures of the sun, designed to prove, or disprove, a theory relating to light, is a much more digestible mental morsel than any story of synthetic chemistry.

Literary tastes may be cultivated, and are based, no doubt, on a suitable preparatory previous experience. Until chemical knowledge has aged, and until a few simple chemical principles have been grasped by the common mind, there is no groundwork or audience to play upon. Some day, simple stories of chemical science will have their appeal, because of the increased number of people who either think they know, or would like to know, something more about fundamental actions and reactions. The beautiful, the artistic and imaginative side of chemistry has yet to be exposed to public view. Its mere utilitarianism or mercantilism is holding back its spiritual growth. In short, chemistry should abandon working clothes just long enough to appear in the right places, with the right people, more frequently.

The Institute of Chemistry, being unable to finance any broad general scheme for the time being, has urged its members to individual effort, and there have been some very valuable addresses given by a few of our leading chemists. Dr. H. E. Bigelow gave an exhaustive analysis of the application of chemistry and research in modern business and industry, before a meeting of the Union of New Brunswick Municipalities. He was made an honorary member, and received many evidences that he had seized a remarkable opportunity with considerable effect.

We need more research workers in the field of chemical publicity. Elsewhere, we report further progress. The old-time method of developing latent literary talent is about to be tried on Canadian chemists. A prize has been offered. It is true that some restrictions are placed on qualifications for the competition, and the cash value may not seem sufficient to persuade some to join the ranks of professional writers; but the important thing is the fact that, at last, a definite move has been made toward finding a Canadian Slosson, Howe, Hendrick or Herty, or a whole series of them, who will shoulder the business of popularizing chemistry in this country.

A PRACTICAL COMMITTEE

WE referred a short time ago to the conference on iron ores in Ontario, held in July, and noted the satisfactory composition of the suggested committee to investigate the question.

The personnel of this committee has now been published, though it consists of six men instead of three, as suggested at first.

With Professors Guess and Haultain, the scientific end of the enquiry is in good hands. The steel interests are competently represented by managers of the two most important plants, and it is to be noted with pleasure that such busy executives as Messrs. Morrow and Cowie have consented to act, and that they have with them, for the commercial part of the work, such an experienced business man and commissioneer as Mr. Lloyd Harris. His record indicates the likelihood of his being chairman.

The transportation interests have a good nominee in Mr. R. J. Hunt, traffic inspector of the C.P.R.

This looks like a well co-ordinated committee, and we congratulate the Hon. Mr. Mills in its selection, and on his sincerity in attacking a problem which, although it immediately affects the question as bearing on ores in Ontario, will doubtless be of great value to the iron and steel industry throughout the Dominion. If we ventured any criticism of the personnel, we would express surprise that the subject of geology is not represented by a specialist. It is an important constituent of the problem complex. No doubt consulting advice in this field will be arranged for with provincial officials as required.

The first action taken is to be on a shipment of 43,000 tons of briquetted ore from the Moose Mountain Mine and the work will be carried on at the Hamilton Steel works. This looks like work on a proper scale. It is expected that the committee will report early in the New Year.

We trust that it will then report progress, but would not expect that any really satisfactory solution could be arrived at in that time, and would strongly urge that sufficient time be given to reach a sufficient report.

THE SIDE LINES OF RESEARCH

WE are not in possession of all the details of Dr. Langmuir's work in connection with the transmission of energy by wireless as the result of work with a new electron tube, but one thing about the press reports is significant of the wide range of work that may be entailed in solving problems of physics or chemistry. As far as we can see from descriptions to hand, success depended upon the welding of copper and glass.

Glass is of variable composition and has a wide range of expansion coefficients. We can imagine that not a little of the "many years development" that was referred to by Dr. Langmuir was occupied in the study of glass and copper, the furnaces and smelters; effects of flame conditions and reactions with furnace gases, and a thousand other variants due to procedure in glass and copper production.

One of the greatest hindrances to industrial scientific progress is the fact that the unscientific mind cannot grasp the idea that apparently simple investigations sometimes involve a range of study covering very wide fields and requiring much time-consuming and painstaking work.

For this reason it is highly desirable that the funds for carrying on investigational work in industry should not constitute an overhead charge. It is the writer's opinion that much of the waste now going on in industrial work, is due to the scanty time and scantier equipment at the disposal of work's chemists, for work other than that purely routine in character.

This difficulty would be obviated and much saving of waste accomplished if routine and investigatory work were to be kept separate; the routine work to be charged to production and the investigation to be carried on by appropriation of surplus funds.

INSULIN

INSULIN spells hope, and a prospect for happy years to come for a great many sufferers from diabetes, because of a piece of chemical research which has been carried to a point where positively favorable results are being secured.

Dr. G. F. Banting and Mr. C. F. Best, two medical research chemists at the University of Toronto, have produced a substance from the pancreas of cattle, sheep and hogs, which at least greatly relieves the disease and opens up possibilities for cure in ordinary cases. This work, at the moment, is being brought to the attention of the medical world and the public generally.

So often, in work of this kind, the public is raised to great heights of anticipation, only to have their hopes shattered. In this case, congratulations are real.

Chemistry still has much to do with the problem. It is hardly likely that ordinary sources of insulin, as known at present, will be sufficient to meet requirements. The yield from these sources may be improved, but the big problem will be in the synthetic production of a very complicated organic substance, about which we know little.

Where the trail is so hot, and the prize so vastly important to human life, there will be no lack of funds and brains for the complete solution.

STOLEN IDEAS

WHAT should be the attitude of chemists who are asked to secure, under false pretences, information which may be considered of particular value to those who would employ them for that purpose? What should be the attitude of companies who have offered to them full and complete details, etc., about the process of a competitor—always for a consideration?

These matters shade off from absolute stealing to the transfer of the knowledge a man may take in the ordinary course of events from one position to another. Some companies present their chemists with remarkable documents for signature, in an effort to make sure that their processes may remain secret.

Perhaps a theoretical chemists' Union would refuse to have its chemists sign such papers. A similar union would have no use for the member who was a travelling source of information, and who was willing to work in non-chemical positions for the information he could secure and sell.

Good practice spreads with the spread of workers, and, in order to avoid entire monopoly and dull all initiative, some other means besides the complete locking-up of information must be arranged. The tendency is toward the open door. Even patents are not relied upon very seriously. Quality, service, price, selling organization, etc., make the business, given equal technical ability. The disposal of so-called formulæ, plans, methods, etc., is a poor game, and we have yet to see it make very much money either for the buyer or the seller. The chemical profession must maintain the integrity of its members and be clean-cut in such matters.

ANTIMONY INDUSTRY IN CHINA

China could readily supply the world's demand for antimony, as her deposits are singularly rich. The firm of Wha Chang, of Changsha, are the owners and operators of the mines in Hunan, and they both smelt and refine the metal. Great improvements have been made in the methods of mining and smelting the ore in China; the industry has been consolidated, and consequently the output of crude, regulus, and refined antimony has been greatly increased. In China the high-grade ores are obtained from shallow and easily worked deposits, and this fact, together with cheap labor, will enable China to retain the position she has already secured in the world's markets.

The Constitution of Rubber*

A New Conception of the Chemical Constitution of Rubber, with a Review of Experimental Work Upon Which Deductions are Based

By Maitland C. Boswell†

AMONG the well-known carbon compounds, whose constitutions still remain to be determined, is rubber. The literature is not wanting in structural formulas, each of which represents satisfactorily one or more of the chemical reactions of rubber. However, none of these is an adequate picture of all the facts which are now known regarding rubber, and the general feeling among organic chemists to-day, even among those who themselves have contributed most to our knowledge of rubber, and advanced constitutional formulas to represent it, is that the rubber molecule is much more complex than pictured by any of the constitutional formulas yet devised.

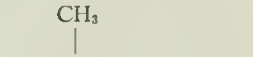
That rubber chemistry should be in this unsatisfactory condition, notwithstanding that sixty-two years have elapsed since Williams in 1860 first investigated the products of the destructive distillation of rubber, may occasion some surprise among those chemists who have not had laboratory experience in the preparation of rubber derivatives. However, it is not at all surprising to any one who has tried to isolate any of the exceedingly fragile and sensitive compounds in the pure state, from the unpromising looking sticky messes, which often result from rubber reactions. None of these compounds is crystalline, and the only method of isolation and purification available is successive solution and precipitation, using as many different solvents and precipitants as are applicable. This has been the chief difficulty. However, an equally important reason for the delay in arriving at a satisfactory representation of the constitution lies, in my opinion, in the unfortunate choice of reactions which have been used for constitution determination. The reactions are altogether too drastic and carry the process of depolymerization of the rubber molecule so far that the final products bear, in most instances, no simple relationship to the original rubber, and have led to the opinion that the rubber molecule is much simpler than it really is. Such reactions as bromination, action of ozone, and of hydrochloric acid gas on rubber, the removal of chlorine from the product of the action of hydrochloric acid gas by heating with pyridine under pressure and others are, though they have given valuable information, too deep seated to enable final inferences to be drawn regarding constitution.

The object of this paper is very briefly to review the facts regarding rubber, which have given rise to the formulas already suggested, and to describe some new rubber reactions and new rubber compounds which substantiate, in a measure, a new constitutional formula which appears not only to be in harmony with the new facts, but also adequately to express the older ones. The chief virtue of these new rubber derivatives, which we have made, for constitutional purposes, lies in the fact that in the reactions used in producing them, the rubber molecule was only very slightly altered, in some cases the depolymerization of the main nucleus of carbon atoms not having occurred, I believe, at all. Evidently such reactions should throw considerable light upon the extent of the rubber molecule, and, in conjunction with those reactions involving a partial splitting off of groups from this nucleus, should enable the derivation of a satisfactory structural formula to be attempted.

Review of Literature

There is no occasion here to review exhaustively the literature. This has already recently been done by others, notably by Harries in Liebigs Annalen der Chemie, and in his Untersuchungen uber Kautschukarten. I shall accordingly review the reactions only in sufficient detail to make clear their bearing upon the problem of constitution.

The products formed by the destructive distillation of rubber were investigated by Williams[1], Wallach[2], Bouchardat[3], Fischer[4], Harries[5] and others. Among the products isoprene and dipentene were identified. The importance of isoprene was emphasized by the discovery by Bouchardat[6] and by Tilden[7] that this hydrocarbon could be polymerized by dilute hydrochloric acid and by long standing to form rubber-like masses.



Tilden[8] had proposed the formula $CH_2=\overset{CH_3}{\overset{|}{C}}-CH=CH_2$ for isoprene, and this constitution was verified by Ipatiew and Wittorf[9]. Ipatiew[10] also showed the so-called isoprene fraction, obtained on distilling rubber, to be a mixture chiefly of isoprene and trimethylethylene.

More recently a number of syntheses of isoprene have been developed both in England and Germany, many of them covered by patents. Also much work has been carried out notably by Harries[11] at Kiel, and by Perkin, Matthew and Strange[12] in London upon the polymerization of isoprene to rubber by means of acetic acid and metallic sodium.

Thus rubber came to be looked upon as a polymerization product of isoprene $(C_5H_8)_x$, especially after Gladstone and Hibbert showed that rubber does in reality possess the empirical formula C_5H_8. It may be mentioned in passing, that these polymerizations products of isoprene are somewhat closely related chemically to rubber, but are not identical with it.

Commercial rubbers were also known to contain varying amounts of acetone soluble compounds called resins. These were found to be oxygen containing compounds, and led to the investigations by Herbst[13] and others of the action of free oxygen on a benzol solution of rubber. Herbst definitely isolated a compound of the empirical formula $C_{10}H_{16}0$. I shall return to the consideration of these compounds presently, in connection with the products of the oxidation of rubber by hydrogen peroxide, by potassium permanganate and by free oxygen, obtained in this laboratory. I only wish, at this point, to indicate that this $C_{10}H_{16}0$ compound was among the first prepared of those derivatives of rubber indicating the existence of $C_{10}H_{16}$ in the rubber molecule.

We thus see how the two ideas which have dominated rubber chemistry have arisen, viz.: (1) that rubber is a polymerization product of isoprene and (2) that the rubber molecule consists of several $C_{10}H_{16}$ groups in combination.

The action of halogens upon rubber was studied by Gladstone and Hibbert[14]. On passing chlorine through a chloroform solution of rubber they obtained a compound, the analysis of which left them undecided between the formulas $C_{10}H_{14}Cl_8$ and $C_{10}H_{12}Cl_8$. Hydrochloric acid was evolved in the reaction, indicating substitution of hydrogen by chlorine, although the major part of the reaction was one of direct addition of chlorine. Using bromine in place of chlorine they obtained as chief product a mixture of compounds of the composition $C_{10}H_{16}Br_4$. Weber stated that the so-called tetrabromide of rubber, after precipitation and washing, had a constant composition. Budde[15] developed an analytical method for the determination of rubber in mixtures based upon this reaction.

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The reaction of hydrochloric acid upon a benzol solution of rubber was studied by Weber[16]. He isolated a product having the composition $C_{10}H_{16}2HCl$. Harries and Fonrobert[17] confirmed this observation and also found that upon repeated washings and precipitations the halogen content decreased considerably. Weber found that upon gentle warming the chlorine content fell from 32% to 18%. Harries found that this could be still further decreased to 12.3% on warming to 100° in vacuo and on heating with pyridine under pressure. That is, the chlorine content fell to below that corresponding to the formula $C_{10}H_{16}HCl$. This was one of the observations which led Harries to an expression of a marked loss of confidence in a $C_{10}H_{16}$ formula of rubber which he had advocated for many years. I will consider this formula presently.

At this stage of the development of rubber chemistry this action of halogens and of halogen acids was accepted as proof that the rubber molecule, consisting of $C_{10}H_{16}$ groups associated together, is unsaturated, each $C_{10}H_{16}$ containing two pairs of unsaturated carbon atoms.

Other work had also been performed on iodine derivatives and upon the action of nitrogen tri-oxide upon rubber yielding the so-called nitrosites. However, these did not contribute anything to the problem of constitution.

This, briefly, was the condition of this problem prior to the year 1910. During this year Lebedew[18] published a paper upon the products of the action of ozone upon some diethylenic hydrocarbons and the products of these so-called ozonides upon decomposition with steam. This work, which was substantiated and expanded greatly by Harries[19], threw a flood of light upon the constitution of rubber. Briefly, it was found that diethylenic compounds when acted upon by ozone add on three atoms of oxygen at each double bond, and the subsequent decomposition of these ozonides yield aldehydes and acids related in a very clear way with the original diethylenic compounds, so that by preparing the ozonides in the case of similar compounds and isolating the products upon hydrolysis it should be possible to derive their constitutions.

This was done by Lebedew and Harries. It was found that the product obtained when a chloroform solution of rubber is treated with ozone, formed, when decomposed by steam, laevulinic aldehyde, laevulinic aldehyde peroxide and laevulinic acid. These investigators concluded that rubber diozonide has the constitution: (Fig. 1), which should decompose in a manner similar to the ozonides of other diethylenic compounds. Accordingly rubber would have the constitution of polymerized symmetrical dimethyl cyclo octadiene: (Fig. 2).

Until quite recently Harries has been an ardent advocate of this constitution. Indeed, it does appear, as Harries has pointed out, to represent many of the conclusions just referred to. It consists of $C_{10}H_{16}$ groups linked together, each $C_{10}H_{16}$ containing two double bonds, which is, as we have seen, in harmony with the conclusions arrived at by investigators up to that time, and it is apparently in harmony with the formation of a diozonide yielding upon decomposition, laevulinic aldehyde and acid. Harries also maintained that it satisfactorily represents the formation of isoprene and dipentene, upon distillation of rubber. It will be observed that in the formation of isoprene the molecule is represented as breaking at two single bonds and not at the double bonds, which are the usual points of weakness. Also in the formation of dipentene a marked intermolecular displacement must be assumed, unless the dipentene has been produced by polymerization of isoprene first formed in the distillation.

Harries also maintained that still further support for this constitutional formula for rubber was obtained from the fact that the synthetic rubber obtained by him by the polymerization of butadiene was identical with a hydrocarbon which Willstatter had prepared from a naturally occurring alkaloid pseudo-pelletierin, and which Harries showed to have the constitution cyclo octadiene. This synthetic rubber and this hydrocarbon gave a diozonide $C_8H_{12}O_6$ which on decomposition yielded succinic acid in the normal fashion. (Fig. 3).

If now, Harries continued, methyl butadiene (isoprene) polymerizes to form a synthetic rubber, after the same plan, it should produce dimethyl cyclo octadiene of the constitution already given, whose ozonide upon decomposition should yield laevulinic acid and aldehyde. However, acetonyl acetone and succinic acid were obtained instead. This, however, is easily understood if the polymerization of isoprene yielded unsymmetrical dimethyl cyclo octadiene instead of the symmetrical compound. So that the synthetic rubber from isoprene has the unsymmetrical constitution, and the fact that acetonyl acetone and succinic acid are formed from the diozonide instead of laevulinic aldehyde constitutes no objection to the main contention of Harries.

Pickles raised the objection that, according to the Harries constitution, "the vague and unnecessary conception of polymerization" is employed, and suggested that the rubber molecule consists of isoprene groups linked up successively in one large ring, thus:

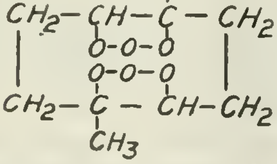


Fig. 1. Rubber diozonide

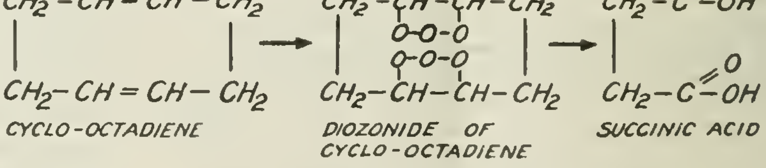


Fig. 3

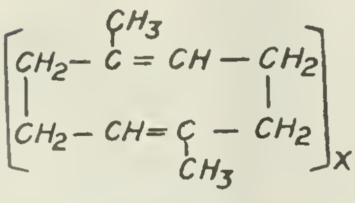


Fig. 2. Dimethyl cyclo octadiene

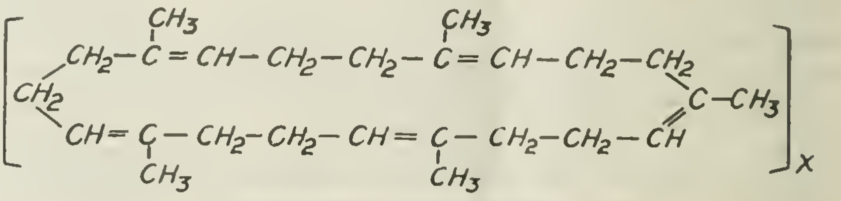
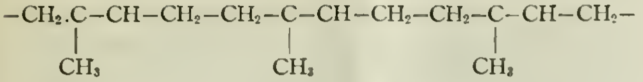


Fig. 4. Harries Formula $(C_{25}H_{40})x$



$$-CH_2.\underset{CH_3}{\underset{|}{C}}-CH-CH_2-CH_2-\underset{CH_3}{\underset{|}{C}}-CH-CH_2-CH_2-\underset{CH_3}{\underset{|}{C}}-CH-CH_2-$$

the ends of the chain being connected so as to constitute a large ring not further polymerized. He further suggested that the various rubbers differ in the number of such nuclei in the ring. That is, Pickles places all the isoprenes in the whole rubber molecule in one huge ring, this molecule not being subsequently polymerized.

It was about this time that Harries became suspicious of the polymerized dimethyl cyclo octadiene constitution, having, among other observations, found that the chlorine content of the hydrochloric acid addition product of rubber, $C_{10}H_{10}$ 2 HCl could be made to fall below $C_{10}H_{16}$ HCl, on heating with pyridine under pressure. It would appear that Harries was scarcely justified in abandoning his constitution on these grounds, for the actions seem altogether too drastic to warrant drawing any definite conclusions at all regarding the constitution of the original rubber molecule. However, he set up a constitution very similar to Pickles, in that five molecules of isoprene are linked together in a single ring. But he adhered to the notion that this large ring must itself be polymerized to a compound of much higher molecular weight $(C_{25}H_{40})_x$. His objection to having all the isoprenes in one ring without further polymerization was that such a compound would not likely depolymerize easily, while it was known that rubber undergoes a change (which Harries called depolymerization) when worked mechanically on hot rolls (Fig. 4).

New Views Regarding the Constitution

In 1917 work commenced on the constitution of rubber in the School of Engineering Research of the University of Toronto. A study of the literature led me to the conclusion that the dimethyl cyclo octadiene constitution of Harries is unsatisfactory for the following reasons:

(1) The formation of two mols of isoprene from one mol of dimethyl cyclo octadiene requires a severing of two single bonds in a molecule containing two double bonds. Double bonds between carbons are usually points of weakness in a molecule and consequently rupture, when it occurs, usually takes place there rather than between carbons joined by a single bond. This had been pointed out by Pickles.

(2) The formation of dipentene from dimethyl cyclo octadiene entails a very extensive intermolecular change, the mechanism of which is not clear unless the intermediate formation of molecules of isoprene is assumed with subsequent polymerization to dipentene.

Were dipentene and isoprene actually linked up as constituents of the rubber molecule both of these objections would be removed.

(3) With double bonds existing in the rubber molecule it should be possible to add hydrogen directly and produce a saturated hydrocarbon. The endeavors of Harries[20] and of Hinrichsen[21] and Kempf to accomplish this failed. Likewise all attempts made in this laboratory were unsuccessful. This would seem to indicate that rubber contains no ethylene linkages at all. Belief in the unsaturated character of rubber depends on the observations that rubber adds on approximately four bromines and two hydrochloric acid mols for each $C_{10}H_{16}$. However, as these are admittedly very drastic actions, almost certainly accompanied by deep seated depolymerization of the rubber molecule, it is conceivable that the rubber mol itself contains no double bonds whatever, and that these are only produced by the breaking up of the complex rubber molecule by the action of bromine or hydrochloric acid. That bromine and hydrochloric acid add to a polymerized compound like rubber constitutes no proof that ethylene linkages are present in the original rubber molecule.

(4) Ditmar[22] has produced a dinitro compound by the action of nitric acid on rubber. This was verified by Harries. Ditmar has shown that this compound is a dinitro cumic acid of the constitution shown in Fig. 5.

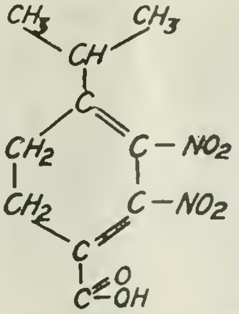


Fig. 5. Dinitro cumic acid

This contains a six membered ring and closely resemble dipentene. Its formation from a molecule containing dipenten as a constituent part could be easily understood. Its formation from a mol containing only dimethyl cyclo octadiene is not capable of any easy explanation.

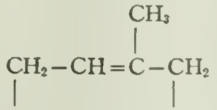
(5) The synthetic rubbers made by Harries from butadiene, methyl butadiene (isoprene) and dimethyl butadiene by polymerization with metallic sodium, and which Harries believes possess the cyclo octadiene structure, are much more easily oxidized than natural occurring rubber. These synthetic rubbers possibly consist solely of octadiene constituents and as a consequence contain ethylene linkages which thus render these synthetic rubbers more susceptible to the action of oxygen, the greater stability of the natural rubber being due to the absence of such unsaturated bonds.

A New Constitution for Rubber

For these reasons a provisional working hypothesis was set up that the rubber molecule contains within it a dimethyl cyclo octadiene part, a dipentene part and an isoprene part.

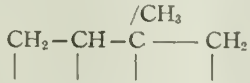
The various probable methods of polymerization of isoprene were then examined. It is obvious that isoprene can polymerize in two ways:

(1) By means of the free bonds, thus:



$$\underset{|}{CH_2}-CH=\overset{CH_3}{\overset{|}{C}}-\underset{|}{CH_2}$$

and (2) by means of the free bonds, thus:



$$\underset{|}{CH_2}-\underset{|}{CH}-\overset{/CH_3}{\underset{|}{C}}——\underset{|}{CH_2}$$

Obviously one mode of polymerization consists of a union of one mol of isoprene exercising the free bonds represented in (2) with two mols of isoprene exercising the free bonds represented in (1) to form the compound represented by Fig. 6.

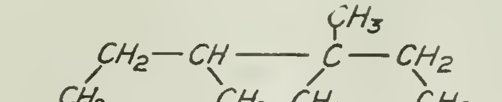


Fig. 6

This contains three isoprene nuclei arranged in such a way as also to contain a dipentene nucleus.

This now contains two double bonds, each of which might conceivably link up with a mol of isoprene by means of bonds as represented in (2), to form a compound such as Fig. 7 (p. 240).

Many other methods of polymerization can be constructed, but upon examination the resultant constitutions do not fulfil the requirements just discussed so adequately as does, I believe, this one.

It represents a compound containing a dimethyl cyclo octadiene group, a dipentene group and an isoprene group. It contains no ethylene linkages at all. It should admit of easy depoly-

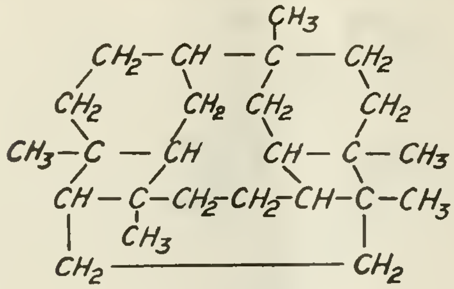


Fig. 7

merization in a variety of ways. Thus it should give rise to derivatives of C_5H_8, $C_{10}H_{16}$, $C_{15}H_{24}$, $C_{20}H_{30}$ and $C_{25}H_{40}$. It will be shown presently that this is in reality so. We have made oxygen derivatives of such molecules from rubber by means of free oxygen, by hydrogen peroxide and by potassium permanganate. Upon action with bromine, no matter in what manner depolymerization should occur, the final product should have the percentage composition $C_5H_8Br_2$ or $C_{10}H_{16}Br_4$. Likewise the hydrochloric acid addition product should have the composition C_5H_8HCl or $C_{10}H_{16}.2\ HCl$. It explains the ready formation of dipentene from rubber and the production of dinitro cumic acid, so closely related to dipentene, observed by Ditmar.

An apparent objection is found in the action of ozone on rubber. At first sight it would seem that since the sole products of the decomposition of the ozonide of rubber, as Harries claims, are laevulinic aldehyde, laevulinic aldehyde peroxide and laevulinic acid, that the possibility of the presence of any group other than dimethyl cyclo octadiene is excluded. Upon closer examination, however, this objection does not seem to be valid. Harries prepared the diozonide of rubber by the action of ozone upon a chloroform solution of rubber. This ozonide was precipitated from solution and washed. The possibility is not excluded, that in the preparation of this ozonide in the pure state, other oxygen products of the action were removed. Unless I have overlooked the statement I can find no mention of a quantitative yield of $C_{10}H_{16}O_6$ having been obtained from a known weight of rubber. What appears to have been obtained was a quantitative yield of the products of decomposition of the purified diozonide. Dingman, in this laboratory, endeavored to determine quantitatively the yield of diozonide obtainable from a known weight of rubber made by Harries method, drawing off the adhering solvent and precipitant in a vacuum at room temperature. However, he was unable to get constant weight as the diozonide decomposed under these conditions, and so no decision could be reached.

Since writing this, my attention has been drawn to a paper by Olivier[22] in which he has obtained the same result, viz., impossibility to obtain constant weight of diozonide. Moreover, Olivier found that he could obtain no constancy of the molecular weight of the so-called diozonide by the freezing point method using benzene as solvent. The values varied from 558 to 869 for moderate treatment with ozone and from 321 to 487 for the product purified after excessive treatment with ozone. Olivier comes to the same conclusion that there is no proof that Harries diozonide is a homogeneous compound. And unless this diozonide of the constitution given is the sole product of the action of ozone then Harries constitution is not valid. Olivier expresses the belief that in spite of the detailed researches of Harries not much progress has been made in the determination of the constitution of rubber.

However, even supposing the transformation of rubber into $C_{10}H_{16}O_6$ does occur quantitatively, this would not constitute a decisive objection to the above formula.

For the action of ozone is of an exceedingly violent sort and must result primarily in a very thorough depolymerization of the whole rubber molecule. It is not inconceivable that the five resulting isoprene residues might rearrange themselves to form a diozonide of dimethyl cyclo octadiene. Each pair of isoprene residues might re-combine to form the single diozonide as in Fig. 8 (p. 243).

Experimental

However probable this constitution which I have devised may appear, from the facts which I have just briefly reviewed, more conclusive evidence is desirable indicating the existence of a $C_{25}H_{40}$ nucleus in the rubber molecule. The experiments which have been carried out by my students (A. Hambleton, R. R. McLaughlin and R. R. Parker) were performed in an endeavor to prepare derivatives of rubber by the mildest kind of action, in order to avoid as much as possible the depolymerization of the rubber molecule. Oxidations by means of a water solution of potassium permanganate, a water solution of hydrogen peroxide, oxygen of the air, the action of iodine and of iodine with hydrogen peroxide were employed.

Oxidation of Potassium Permanganate—Experimental Work by A. Hambleton

The rubber for these experiments was prepared by extracting about 200 g. of para rubber, cut up into small pieces, with hot acetone. The acetone was poured off frequently and fresh acetone added. This was continued for eight days, when the extract was found to leave no residue on evaporation. The excess of acetone sticking to the rubber was evaporated on a water bath, the rubber dissolved in carbon tetra chloride and filtered through glass wool, and the solution poured slowly with stirring into approximately twice its volume of methyl alcohol. The rubber precipitated as a white gummy mass. This was warmed in a steam oven for an hour to drive off the excess of solvents and the remainder drawn off under suction.

7½ grams of rubber dissolved in 150 c.c. carbon tetrachloride, 11.62 g. powdered potassium permanganate, and 150 c.c. water were placed in a 500 c.c. glass stoppered bottle and shaken for five days at room temperature. At the end of this time the permanganate color had disappeared. The contents of the bottle were then filtered on a large Buchner funnel. The water and carbon tetrachloride in the filtrate was separated in a separating funnel. The carbon tetrachloride solution was concentrated to half its bulk under suction, and at a temperature not exceeding 45°.

The clear colorless solution was poured into twice its volume of pure methyl alcohol in an erlenmeyer flask. Here it was washed by decantation with acetone, ethyl alcohol and methyl alcohol. The white pasty mass was then freed from solvent by a high vacuum in the cold. Samples of this were analysed, giving the following results:

Analyses (1)

Substance	H_2O	CO_2	%C	%H	%O
.1764 g.	.1808	.5405	83.7	11.4	4.9
.1511	.1538	.4653	84.1	11.3	4.6
.1386	.1427	.4283	84.4	11.4	4.2

Although the greatest care was taken to exclude free oxygen in the drying of this product and in removing the last traces of solvent, yet for certainty the preparation and purification was carried out twice again. The additional precaution was taken of dissolving the preparation finally in petroleum ether (B.P. 31-42) and evaporating the solvent in a high vacuum in the cold, in this way assisting in the removal of any traces of methyl alcohol which was the washing liquid used just prior to solution in the petroleum ether. This solution in petroleum ether and evaporation was repeated. In this way it was reasonably certain that every trace of oxygen holding solvent was removed. In the second repetition this was also done, using benzol instead of petroleum ether. This was the more necessary as Harries[23] and also van Rossem[24] studied the action of potassium permanganate on rubber and were unable to isolate any oxidation product related to rubber. Following are the results of analyses:

Analyses (2). Using Benzol

Substance	H_20	$C0_2$	%C	%H	%0
.1244	.1316	3832	84.1	11.7	4.2
.1764	.1808	.5405	83.7	11.4	5.9

Analyses (3). Using Petroleum Ether

Substance	H_20	$C0_2$	%C	%H	%0
.2000	.2076	.6125	83.5	11.5	5.0
.1734	.1751	.5290	83.7	11.2	5.1

Collecting the analyses and comparing with the calculated values for $C_{25}H_{40}0$.

	C	H	O
Found	83.7	11.4	4.9
	84.1	11.3	4.6
	84.4	11.4	4.2
	84.1	11.7	4.2
	83.7	11.4	5.9
	83.5	11.5	5.0
	83.7	11.2	5.1
Average of Found	83.9	11.4	4.8
Values Calculated	84.3	11.2	4.5

There seems to be no doubt that an oxygen compound of the composition $C_{25}H_{40}0$ has been prepared.

This compound readily takes up oxygen on warming slightly in the air or even on standing in the air for a short time at room temperature. Upon analysis of two different preparations the following results were obtained:

Substance	H_20	$C0_2$	%C	%H	%0
.1903	.1906	.5574	81.2	11.1	7.7
.2031	.2016	.6081	81.7	11.0	7.3
.1935	.1925	.5733	80.8	11.1	8.1
Average			81.2	11.1	7.7
Calculated for $C_{25}H_{40}0_2$			80.65	10.75	8.6

This latter compound was prepared in a purer condition from the reaction product of hydrogen peroxide on rubber, according to details described later in this paper.

The freshly precipitated $C_{25}H_{40}0$ compound is easily soluble in ether, petroleum ether, carbon tetrachloride, chloroform, benzol, carbon bisulphide and insoluble in ethyl alcohol, methyl alcohol and acetone.

It has a dough-like consistency. It is apparently unacted on by cold acids and bases and rapidly takes up oxygen from the air when warmed and more slowly at room temperature, combining with one atom of oxygen for every mol of $C_{25}H_{40}0$.

Action of Hydrogen Peroxide—Experimental Work by R. R. Parker and R. R. McLaughlin

5 g. rubber dissolved in 125 c.c. carbon tetrachloride and 125 c.c. of a 3% hydrogen peroxide solution were placed in a glass stoppered bottle and shaken for one week at room temperature. The whole was allowed to stand twenty-four hours and then filtered when only a small residue remained. The water and carbon tetrachloride in the filtrate were separated and each evaporated at ordinary temperature under suction. The water solution evaporated to a white sticky material which, on attempting to dry to constant weight, was found to absorb oxygen rapidly, when taken out of the vacuum vessel, for weighing. This compound will be investigated later.

The residue from the evaporation of the carbon tetrachloride solution gave a transparent, bright yellow substance fairly hard, at room temperature. This was found to be mostly soluble in ether and leaving a residue insoluble in ether. The separation was made by extracting with two portions of ether for eight hours each. The combined extracts were evaporated at room temperature to about 25 c.c. and methyl alcohol added when a white gummy mass was obtained. This was filtered off and washed with methyl alcohol, ethyl alcohol and acetone and dried to constant weight at room temperature under suction. This was again partially dissolved in ether, filtered, precipitated and washed as before and dried to constant weight. The substance was now analysed, giving the following result:

Substance	H_20	$C0_2$	%C	%H	%0
2827 g.	2758	.8872	.85.59	10.84	3.57
2879	2870	.9025	85.49	11.07	3.44
Average			85.54	10.96	3.50
Calculated for $C_{30}H_{48}0$			84.90	11.32	3.78

A sample of this compound, which had stood for some time in the air, was partially re-dissolved in ether, filtered, precipitated, washed and dried to constant weight. Analyses were as follows:

Substance	H_20	$C0_2$	%C	%H	%0
2768	.2570	.8153	80.33	10.31	9.36
3013	.2844	.8875	80.33	10.48	9.19
Average			80.33	10.40	9.27
Calculated for $C_{25}H_{40}0_2$			80.64	10.75	8.61

This compound appears to be identical with the $C_{25}H_{40}0_2$ compound just described as one of the products of the oxidation of the $C_{25}H_{40}0$ compound in the air.

This would indicate that a nucleus $C_{30}H_{48}$ occurs in the rubber molecule and that the first product of oxidation is $C_{30}H_{48}0$. This compound readily loses an isoprene group and becomes $C_{25}H_{40}0$. In place of this C_5H_8 group an oxygen then enters, giving the compound $C_{25}H_{40}0_2$. This is entirely in harmony with the above results. It is also verified by the fact that in the hydrogen peroxide oxidation of rubber a water soluble oxidation product, already referred to, is formed which probably results from the oxidation of this isoprene group which has been split off. Also Hambleton, in this laboratory, observed that when rubber is oxidized by potassium permanganate in the preparation of the $C_{25}H_{40}0$ compound, there is a water soluble oxidation product as well as considerable carbon dioxide formed. He measured the amount of carbon dioxide formed in the oxidation and found that about 5% of the rubber was oxidized to carbon dioxide. It seems, then, that there is an isoprene group which is readily oxidized by permanganate partly to a water soluble acid and partly to carbon dioxide. The hydrogen dioxide oxidation leaves some of this unstable $C_{30}H_{48}0$ unattacked. The probable mechanism of these changes and the constitution of the $C_{30}H_{48}$ molecule will be discussed presently in this paper.

The material insoluble in ether was dissolved in a small amount of carbon tetrachloride and precipitated by methyl alcohol, washed and dried at room temperature in a vacuum to constant weight. This was a sticky mass which had a resin-like odor. There was only enough material for a single analysis.

Material	H_20	$C0_2$	%C	%H	%0
.2477	.2427	.7392	81.39	10.80	7.81
Calculated for $C_{15}H_{24}0$			81.81	10.90	7.29

On heating some of the above ether soluble compound to 100 degrees it became partially insoluble in ether. Whether this ether insoluble part is the same as the ether insoluble compound whose analysis has just been given is not known. It will be investigated later.

Action of Oxygen of the Air on Rubber—Experimental Work by R. R. McLaughlin and R. R. Parker

About 300 g. of resin-free rubber was rolled out into very thin sheets and suspended in frames in direct sunlight for three months. It was then extracted with acetone for two days and the acetone extract was evaporated at room temperature. Approximately 30% of the rubber had resinified. It was found that a separation of the resin could be accomplished with carbon bisulphide. The whole of the resin was extracted at room temperature with carbon bisulphide and filtered at the pump, leaving a residue. The carbon bisulphide solution was evaporated at room temperature and the residue so obtained was dissolved in acetone, using a large amount of solvent to facilitate filtration and the whole filtered. This solution was evaporated at room temperature to a small bulk and the compound precipitated with methyl alcohol. This was filtered and dried to constant weight under suction. This gave a tough rubbery substance.

The part of the oxidation product insoluble in carbon bisulphide was shaken for twenty-four hours with carbon bisulphide to remove all the carbon bisulphide soluble and filtered. This was dissolved in acetone for the purpose of precipitating it, but the precipitate with methyl alcohol was of such a consistency that it could not be separated effectively from the solvents. The whole was evaporated at room temperature under suction and gave a hard, brittle and transparent mass.

Analysis of Compound Soluble in Carbon Bi-Sulphide

Material	H_2O	CO_2	%C	%H	%O
.2482	.2278	.7141	78.47	10.15	11.38
.2956	.2760	.8532	78.72	10.37	10.91
Average			78.59	10.26	11.14
Calculated for $C_{10}H_{16}O$			78.95	10.53	10.53

Analysis of Compound Insoluble in Carbon Bi-Sulphide

Material	H_2O	CO_2	%C	%H	%O
.3076	.2328	.6997	62.04	8.41	29.55
.2912	.2105	.6649	62.27	8.03	29.70
Average			62.16	8.22	29.62
Calculated for $C_{25}H_{40}O_9$			61.98	8.26	29.76

Action of Hydrogen Peroxide and Iodine on Rubber—Experimental Work by R. R. McLaughlin and R. R. Parker

5 g. rubber dissolved in 125 c.c. carbon tetrachloride, 125 c.c. of a 3% hydrogen peroxide solution, 100 c.c. of a 2% solution of iodine in carbon tetrachloride were placed in a glass stoppered bottle and shaken for two weeks at room temperature. It was allowed to stand for twenty-four hours when it separated in two layers. The whole was filtered at the pump, requiring several hours, washed with carbon tetrachloride, dried in air at temperature not above 30°C. The product was then rubbed up in a mortar and extracted with carbon tetrachloride to remove all free iodine, dried, dissolved in ethyl acetate and filtered. The residue on the filter was washed several times with ethyl acetate and dried to constant weight. A light yellow solid was obtained.

The filtrate containing the part soluble in ethyl acetate was evaporated under suction at room temperature with the exclusion of direct sunlight, as this solution, if exposed to light and air, becomes black in color. The solid obtained was partially re-dissolved in ethyl acetate, filtered and evaporated as before to constant weight. It has a varnish-like appearance and on scraping off the dish and grinding, was a brownish-yellow powder.

Analysis of Compound Soluble in Ethyl Acetate

Material	H_2O	CO_2	%C	%H	%I	%O
.2520	.1479	.4791	50.77	6.52	21.34	21.54
.2470	.1608	.4538	50.10	7.23		
.2108	.1234	.3884	50.25	6.54		
		Average	50.37	6.76		
	Material		Silver Iodide		% Iodine	
	.2500		.0990		21.34	
			%C	%H	%I	%O
Calculated for $C_{25}H_{40}O_8I$			50.42	6.72	21.34	21.59
Found			50.36	6.76	21.34	21.54

No solvent could be found for the compound insoluble in ethyl acetate and as it was obviously impure it was set aside and will be investigated later.

Interpretation of Results

The results of the experiments just described seem to receive an adequate explanation as illustrated in Fig. 9. (P. 243)

Rubber consists of six isoprene molecules polymerized to form a molecule $C_{30}H_{48}$ of the constitution shown in formula 1. Upon oxidation with hydrogen peroxide this is oxidized first to $C_{30}H_{48}O$, probably of the constitution shown in formula 2. This is the beginning of the insertion of oxygen between the isoprene groups. This compound readily loses its central C_5H_8 group, which is, as we have seen, oxidized to CO_2, and a water soluble compound, and an oxygen enters the molecule in its place, making the compound $C_{25}H_{40}O_2$ represented by formula 3. This compound $C_{25}H_{40}O_2$ can also be made by the oxidation of rubber by potassium permanganate. In this case the central isoprene is oxidized off to CO_2 and a water soluble compound, and $C_{25}H_{40}O$ is formed, which is represented in formula 4. This readily takes up oxygen and passes into $C_{25}H_{40}O_2$, represented in formula 3. Another product of the oxidation of rubber by hydrogen peroxide has the composition $C_{15}H_{24}O$. This probably forms from the further oxidation of the $C_{25}H_{40}O_2$ compound, whereby the split occurs along the line x—x, the two free bonds uniting with an oxygen to produce $C_{15}H_{24}O$ of the constitution in formula 5. It is probable that another oxidation product $C_{20}H_{32}O_2$ is also formed in this reaction, of the constitution represented in formula 6, although this was not isolated. However, this compound was found among the oxidation products of rubber by oxygen of the air. In this oxidation of rubber by air the final product of the oxidation before the molecule disintegrates is $C_{25}H_{40}O_9$, represented by formula 7. Here the five isoprene groups are separated from each other by oxygens. The molecule is unable to take up more oxygen without rupture.

The action of iodine and hydrogen peroxide on rubber gives two compounds only one of which was purified and analysed. It has the composition $C_{25}H_{40}I\ O_8$. An important consideration in arriving at its constitution is the fact that iodine alone acts with very great slowness on rubber but that in the presence of oxygen it acts at once with the entrance of a single iodine and eight oxygens for every $C_{25}H_{40}$. Since the final product of oxidation of rubber by free oxygen has the composition $C_{25}H_{40}O_9$, it seems highly probable that this single iodine serves to link up the five isoprene groups in the $C_{25}H_{40}$ molecule occupying then a central position in some such way as represented in formula 8. This requires another oxygen in order to make up the required eight oxygens. This is represented as united to the iodine by a single bond. A second residue may possibly be united to this at the two oxygens giving the molecular formula $C_{50}H_{80}I_2O_{16}$. Only a molecular weight determination can decide whether any combination of this kind occurs. Iodine here acts with a valency of five, which is not unusual for iodine as it is found with this valency in iodic acid and iodine pentoxide.

Summary

A survey of the facts of rubber chemistry is given and a criticism of the interpretations of these facts by previous investigators presented.

A new constitutional formula for rubber is advanced, which seems more in harmony with these facts.

Some new oxygen and iodine derivatives of rubber are described which substantiate this constitution.

Provisional formulae are presented for the constitutions of these derivatives.

This work is being continued in this laboratory.

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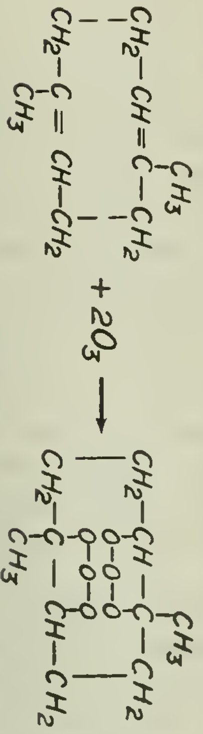

Fig. 8

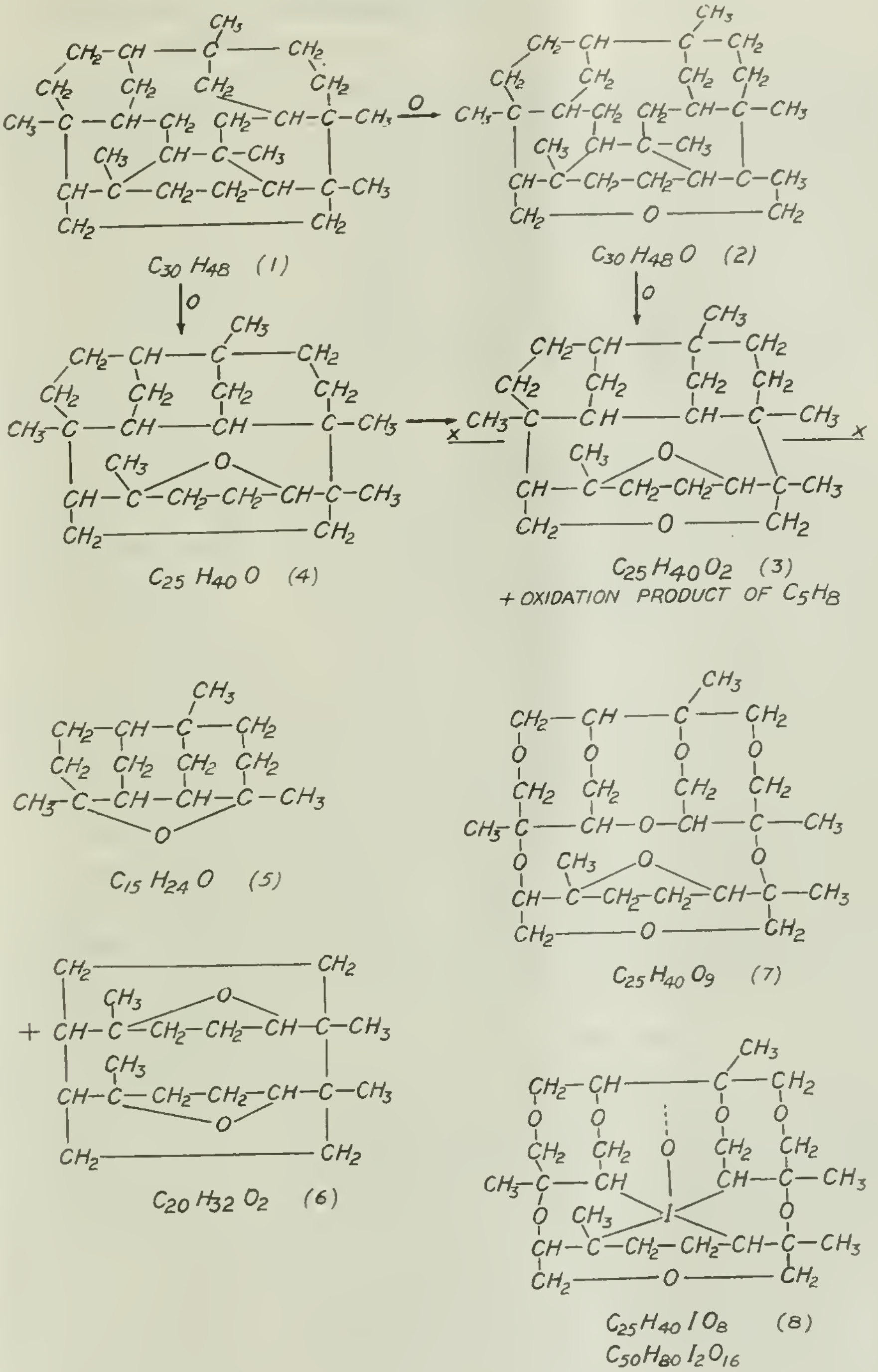

Fig. 9

REMOVAL OF SULPHUR FROM ILLUMINATING GAS

The use of coals of the central American coal mining district for gas manufacture owing to their relatively high sulphur content, makes the purification of gas for domestic and industrial uses an increasingly difficult problem; in fact, with the gradual exhaustion of the choice low-sulphur coal beds, gas purification is becoming generally more of a problem to the gas industry. Commercial hydrated oxide of iron, the commonly used purifying agent, varies widely in its quality as a gas purifier. No completely satisfactory laboratory methods for the evaluation of oxides now exist. The United States Bureau of Mines is co-operating with the American Gas Association in the effort to perfect testing methods and to learn more concerning the effects of different chemical and physical conditions on the properties of hydrated iron oxide in use for gas purification. Among the conditions affecting the use of oxide studied during the present year are moisture temperature, iron content, and sulphur content of oxides, and hydrogen sulphide content of the gas to be purified. A report covering the results of these studies is now in preparation.

SULPHUR EXPORT ASSOCIATION

The Union Sulphur Co., the Freeport Sulphur Co., and the Texas Gulf Sulphur Co., have combined to form the Sulphur Export Association, to handle the sale of their product in foreign markets.

Some Economic Considerations Related to the Manufacture of Dyestuffs in Canada

By C. R. Wright*

THE very large amount of attention given to the production of dyestuffs in Germany, England and the United States, has possibly clouded the conception of what rests behind these gigantic struggles for supremacy. No doubt, the national welfare in time of war demanded factories which may be diverted to war necessities and a strong chemical industry turns up research and progress in all directions. But, forgetting, for the moment, the national necessity from the viewpoint of the military authorities, we have, in all countries, a capacity for the manufacture of dyestuffs, roughly estimated as being perhaps twice our world requirements. Already plants have been thrown into the discard and a very great amount of capital has been lost. Each great producing country is faced with its own set of peculiar difficulties. Germany is racing to a new type of national bankruptcy. England is dependent on foreign markets and is very close to European chemical competition, with an exchange situation and taxes acting as a tremendous burden. The United States has recently passed the highest tariff wall ever erected, which should reasonably assure that country of a high percentage of the American market for the American manufacturer. The fact remains that the capacity in each country, as far as dyestuffs are concerned, can easily exceed any possible market.

Under such a condition, two types of organization alone can exist—the very large and the very small. The very large puts out of business those near competitors, but does not find it profitable to remove the very small manufacturer. The situation in Canada in dyestuffs is extremely peculiar. Almost all large international producers are selling in this relatively small market. German dyes, Swiss dyes, English and American dyes, all seem to be able to compete, each one possessing certain favorable and unfavorable factors, all balancing so that no single country seems able to exclude others. Canada is, as far as tariff goes, an unprotected market, and our textile industries should be in the position to reap certain benefits from this situation.

During the past two years, several companies have considered manufacturing colors from intermediates in Canada, and the fact that these have been made, and are being manufactured, appears to be a matter of great wonder to Canadian chemists, the textile industry and the dyestuff industry in general. An analysis of the situation, however, demonstrates that the inherent risk in the establishment of a Canadian dyestuff industry, even on a non-protected basis, is no greater than that involved in any other industrial undertaking, provided the management knows the business. A survey of industrial affairs over the last two years will show that casualties among companies operated on conservative lines, by people who were able to secure reductions on overhead, were less than among the very large organizations, where a type of efficiency is gained, but only at great strain on the margin of profit. The higher you rise, the harder you may hit, should circumstances cause a fall. Raw materials and equipment have been going as relative bargains.

In spite of the fact that the dyestuff industry is remarkably complicated, when viewed as a whole, it is easily possible to separate it into more or less self-contained units. It is a fallacy to believe that, in order to have real efficiency, a plant must be producing a long line of colors. Granted that there is a competitive price on intermediates, it is just as logical to make a few standard colors largely used in the industries right here in Canada, as it is to make soap or tooth paste. Neither is it reasonable to suppose that a process which works perfectly well in Germany, England, or the United States, will suddenly become different if started in a Canadian city. These are the inherent difficulties in erecting a dyestuff industry in Canada, rather than those connected with chemical manipulation. The Canadian public, the Canadian textile industry, and Canadian chemists themselves, have been taught to believe that it is impossible, and, therefore, it must be so. Style, custom, precedent, and the desire for the imported product, are still heavier than chemical and practical data with a high proportion of people in all countries.

The economic side of the question of manufacturing dyestuffs in Canada may be approached from an analysis of the market and the processing involved in making those colors for which there is the greatest demand. By reducing selling costs of all kinds, and by limiting the colors made, and the plant required, and by employing color makers who can operate any part of the process, as well as it is operated anywhere else, the Canadian-made color should be placed in the hands of the user at a competitive price, and should give the user complete satisfaction. We are referring, of course, entirely to the making of colors from imported intermediates, although, in a small way, it should not be impossible to make the business partly at least self-contained.

Consider some of the chief organic reactions involved in producing intermediates. It is not a terrific problem to nitrate benzol and secure aniline on reduction by hydrogen. Aniline is used in the manufacture of nearly one hundred colors, and is the base for aniline salt, hydroquinone, sulphanilic acid, phenylhydrazine, dimethylaniline, phenylglycine, hydrazobenzol, benzidine. Benzidine itself is the base of no less than eight substantive cotton dyes.

Phenol on nitration yields mono-di-tri-nitrophenol, and on reduction mononitrophenol yields para amido phenol, which is used in the production of at least a dozen colors. The sulphonic acids of para amido phenol are equally important. In another direction, from phenol, we get salicylic acid and aspirin.

Starting with naphthaline, the amido-naphthol sulphonic acids are made, and are essential to a wide range of azo dyes. From anthracene, through anthraquinone, comes alizarin. All told, some four hundred and eighty-four dyestuff intermediates have been made, each calling for an individual process.

The Basis of Some Scale Operations

A particular company, or country, may be producing few or many of these, without producing them all, and still be operating on a fundamentally sound basis. Because they are not all possible for Canada does not mean that some cannot be made successfully, as no single company in Germany or elsewhere will ever produce a complete line in the above sense. It seems logical and apparent that, as time goes on, highly efficient but smaller units may be erected in various countries where a steady demand is assured.

In Canada, some three million pounds of aniline dyestuffs are consumed annually. While accurate information is not available on the amount of each color, it is probable that sixty per cent. of the imports are either acid or direct blacks and direct blues. Perhaps twenty-five colors are used in considerable quantity in Canada, out of the possible forty-five hundred. These would be the limit of present possible manufacture. On the other side, such colors as indigo, patent blue, rhodamine and auramine, demand such an expenditure for equipment that their manufacture could not well be considered while the market remained so restricted.

Out of the possible ones, those related chemically would naturally be undertaken. For example, a group of six standard colors, such as direct black, direct blue, acid black, chrome black, benzo sky blue, and direct green, would form a series of azo dyes, which could be made by coupling a diazo compound with an amine or phenol. The equipment involved for one unit would be four wooden tanks, a filter press, an air compressor, one ball mill and a dryer. Assuming that the consumption in Canada of the above-mentioned range of colors was two million pounds per annum, and it were possible to secure eighteen per cent. of this, it would amount to an output of one thousand pounds per day. Under conditions which can be readily secured, the overhead cost on this would be not above five cents per pound, including depreciation.

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The writer does not wish anyone to think that this is a stock-selling prospectus, as the limiting factor in such a business is probably the knowledge of the actual dyestuff-maker in charge; but there is a necessity that some one should take much of the mystery out of the dyestuff business, reducing it to where it belongs, as an ordinary manufacturing operation, subject to all the laws that govern investments and the management of any ordinary business. It seems strange that there should be a necessity for continually repeating that Germans, Americans, or Canadians can make colors equally well, if they know how. As far as widely used colors are concerned, no one country has much to learn from the other at the moment. A dyestuff industry is not inherently related to the climate or the side of the earth on which you live.

Possibilities of Intermediate Manufacture

For the above range of colors, H acid is the most important intermediate. This substance (1 amino 8 naphthol 3:6 disulphonic acid) and benzidine could possibly be made in Canada. H acid in general is made by the sulphonation and subsequent nitration and reduction of naphthalene. The naphthalene is added to monohydrate in a sulphonator and the temperature held at 160°C. for eight hours. The charge is then cooled to about 90°C., and 65% oleum added, and the temperature maintained at 160°C., for six hours. The charge is then cooled to 120°C., and blown to a nitrator where ice is added to bring the temperature to 20°C. 63% nitric acid is run in, keeping the temperature below 35°C. The nitrator charge is next blown into ice and water and iron added every thirty minutes during forty-eight hours, at a temperature of 35°C. When nitration is complete, salt is added and the charge stirred for six hours, after which it is filtered. The crude Koch acid thus formed is purified by treatment with sodium carbonate, filtering and acidifying, re-filtering after Koch has settled out. The Koch acid is next added to caustic soda in an autoclave and heated to 180°C., for two hours, after which it is blown into water and ice and made almost acid with hydrochloric. It is again filtered and the filtrate returned to the tub, where acidification is completed, the SO_2 boiled off, cooled to 50°C., and H. acid filtered off.

Benzidine is made by reducing nitrobenzol with zinc dust in the presence of solvent naphtha and caustic soda. The resultant hydrazobenzol is inverted to benzidine hydrochloride by means of hydrochloric acid.

The other intermediate used in any quantity in the set of colors discussed is para nitro aniline, and this is of interest to the dry color trade. This is made by nitrating acetanilide and then hydrolizing paranitracetanilide formed with sulphuric acid. These three processes involve similar operations, and the H. acid plant equipment could be arranged so that the three products could be made in the one unit, by running the plant alternately on one and the other.

These methods are not explosive patents, and have no more inherent difficulties when in proper hands than baking bread. Where the material is used directly, a paste form is all that is required. By this, and other plans, it should appear reasonable to expect that even a small market like the Canadian should stimulate some of our chemists now breaking down much more difficult industrial doors to attempt to make in a small way some of the more common dyestuffs. It is probable that there are several lines of manufacture open to chemists where a foothold could be secured with a Canadian product, if the idea was once thrown away that it was necessary to start on a large scale.

If there be any secret about such small scale organic or chemical manufacturing work, it rests in always keeping the product up to the best possible standard. It must meet the imported product in quality and price both, and if this is done, there should be no worry, as the volume curve will more than likely go up.

The importance of a dyestuff industry or even a coupling industry in Canada is great, if it does nothing more than demonstrate to chemists that the theoretically impossible is being done every day, and that maybe the grass is just as green in front of your door as it is on the distant hills. To build up a chemical business in a small way calls for courage, perseverance and patience. "There would be few enterprises of great labor or hazard undertaken," says Dr. Johnson. "If we did not have the power of magnifying the advantages we persuade ourselves to expect from them."

CHINA CLAY IN QUEBEC

After several starts, it appears that the Canadian China Clay Company may be in a position to produce a good grade on an economical basis. The deposits being operated are at Huberdeau, Quebec.

The Kaolin zone is about 1 000 feet wide and 7,000 feet long, but has not been fully prospected. The china clay occurs in veins and pockets in quartzite rock. Much of the clay in the best zone is stained with iron, but makes a very good fire clay. Regular mining methods are used. A shaft 100 feet has been sunk and a lens some 200 feet by 60 feet developed. This is but a very small portion of the zone, which appears to contain good clay. The clay is easily disintegrated and washed, and much of the sand and quartz can be shovelled out from the water. The water carries fine sand and clay through two series of troughs, 500 feet long, where the fine sand settles. The clay-bearing water then runs through a revolving screen to remove chips and is allowed to settle in tanks. After twenty-four hours, the supernatant water is returned to the system and the thickened pulp in the settling tank is pumped through filter-presses at 100 pounds pressure. The filter cakes are dried on racks in carloads in a drying tunnel, through which is blown a stream of air, heated by steam coils.

USE OF STEAM IN COAL GAS RETORTS

The tendency toward lower standards of quality of gas in public utilities has increased the interest of the gas industry in processes that promise to increase the yield of gas per pound of coal coked, even though attended by a decrease in quality. The introduction of steam during or at the close of the coking process has shown considerable advantage in certain types of gas-making installations, notably in vertical retorts. The Bureau of Mines, through W. A. Dunkley, gas engineer, has co-operated with the American Gas Association in studying the effects of using steam in horizontal retorts, which are commonly used. It was found that the method of admitting steam had much to do with the results obtained. Little, if any, water gas was generated by decomposition of steam in the retort charge, unless the contact between the steam and the charge was intimate. Steam as usually practised in the small gas plant, where the process has been tried, has no advantage. With prevailing standards of gas quality, little advantages can be taken of the use of steam, even if properly applied, as the production of any appreciable volume of water gas considerably reduced the general quality of the total gas production. Should standards be further reduced, the process might show more marked economies.

During 1921, twenty-seven employees were killed, and 4,494 injured during operations at smelters and mine mills in the United States, excluding iron blast furnaces

Principles of High Temperature Furnace Design[*]

By E. L. Smalley[†]

ELECTRIC furnace designers should profit by the experiences of fuel furnace builders. The chief aim and ambition of fuel furnace builders have been to attain a furnace which will give a uniform temperature throughout the entire furnace chamber. This is perhaps the chief requirement of any furnace, irrespective of whether it be fuel or electric. It certainly is the most desirable characteristic to secure in an electric furnace.

The designers of fuel furnaces have gone through a tedious course of modifying the designs to secure uniformity of temperature. In the case of gas or oil furnaces they have increased the number and changed the distribution of burners with this aim in view. They have tried under-fired furnaces, over-fired furnaces and furnaces with burners impinging flames only through the side wall. They have changed to modifications of these types so that by means of flues they could better distribute the heat around all sides of the furnace chamber.

They have always been handicapped by the fact that the greatest temperature exists at the point of greatest combustion. This combustion temperature, oftentimes in excess of the temperature they wish to utilize, must be decreased at the point of application to the work to be performed.

The electric furnace designer has the advantage of all the experience of the fuel furnace designers, but in the case of the electric furnace the heat is developed solely within the furnace chamber, and the electric furnace designer, therefore, has the marked advantage of being able to distribute his heat uniformly as needed for the work to be performed. Unlike fuel furnaces, which oftentimes must be increased in chamber size so that the work to be heated could be far removed from excessively hot spots of the fuel furnace, the electric heat may be so distributed that this is not necessary.

Furnaces may be either of the exposed element type, or the elements may be covered with refractory plates; the latter being so-called "muffle plates" and the furnace a muffled furnace. The choice lies with the designer, but due consideration should be given to the results attained. In a muffled type of furnace annealing glassware goblets were placed in parts of the furnace within 1.5 inches (3.8 cm.) from the source of heat. With the same current density, exposed elements would have melted the goblets. The current density of a heating element in a muffled furnace and the current density in the heating elements in an exposed element furnace must both be made to suit the required conditions. Muffled type of furnaces have certain advantages regarding the exclusion of a large portion of the oxidizing atmosphere of the furnace, and unquestionably the elements are, therefore, protected from oxidation to a marked degree. A muffled furnace is an insurance for the operator against contact with the furnace coils. In some processes, owing to its being the only method of correct application, the muffled type of heating element is absolutely essential to the success of the equipment.

It is wise to have the heating circuits of any furnace divided into several coils. This will lessen the cost of maintenance, as it cheapens the cost of renewal of any one burnout. It makes easier the replacement of the element by the operator. It lowers the amount of capital tied up in spare or extra coils on hand for emergency service.

The weight of unsupported portions of elements should not be excessive. Proper support of elements will prevent distortion of elements at the high temperatures they are sometimes called upon to sustain. Such distortion may cause the necessity of "crimping" the elements to bring them back to the original overall length. Crimping or changing the original form weakens the element for subsequent expansion and contraction, and may result in short circuiting of the elements. It is a practice that should be avoided.

Allowance for expansion and contraction of refractory parts in the furnace must be provided. The expansion and contraction of the heating elements in the heating and cooling periods of the furnace must be arranged for, and during such expansion and contraction the original form of the heating element must be maintained.

All connections of the power source to the furnace circuits should be made outside the furnace. Where the terminals of heating coils extend through furnace walls the cross-sectional area of the terminals should be increased above that of the main body of the heating element, as otherwise there would be local overheating in the terminals. In placing heating elements in the bottom of furnace chambers thorough protection against contact with foreign substances should be provided. This has been accomplished in a large number of instances by means of cast non-oxidizing floor or cover plates. These floor or cover plates may be provided with lock-joints to exclude foreign substances and still provide means for expansion and contraction of the floor plates. The structure under such floor or cover plates must be such that the bottom coils are free to expand and contract, same as any other coils, and they must be kept in proper alignment.

Uniform Temperature Dependent on Distribution of Source of Heat

An electric furnace is not successful simply because it is electric. Marked errors in design may exist which will be detrimental to the most efficient results. An electric furnace can have over-heated zones; the same furnace can also have low temperature zones. Uniform temperature depends entirely upon the uniform distribution of the source of heat. Heat rays follow the same laws as light rays. In order to have the same density, or intensity, of light on all sides of an object, the source must be from all sides. So it is with heat rays. The uniform distribution of heat in the electric furnace should not be sacrificed to the convenience of the method of mounting the heating elements.

The design of the heating element must necessarily be one that can be readily mounted on any wall and in the floor of the furnace chamber. Even car-bottom furnaces have been successfully operated, wherein some of the heating elements are located on the floor of the car. Power connections are made with the customary type of third rail contact shoes.

The temperature will not be uniform unless the heat source is uniformly distributed in the heating chamber.

It is a grievous fault of some electric furnace designers that they design the height and width of the chamber to suit the application of the heating element. Of course, the size of the charge to be placed in the furnace should be the sole factor in determining the furnace dimensions. Any enlargement of the furnace to suit the elements, invariably results in a greater radiation loss, and consequently a lower thermal efficiency. A difference of five per cent. in the efficiency of a two hundred kilowatt furnace amounts to $748.80 in one year, with current at one cent per kilowatt hour and the furnace operated 144 hours each week. Yet a reduction of ten per cent. in efficiency can easily be made by a false choice of size. Weigh furnaces, in part, by their efficiencies.

Consider three furnaces all having the same full load or kilowatt rating, and each having exactly the same radiation losses, and therefore, the same thermal efficiency. One hundred kilowatts per hour can be released in a furnace heated by a single arc, and likewise 100 kilowatts per hour can be released in another furnace where the total source of heat is from the side walls. A third furnace may be designed so that the 100 kilowatts per hour is released uniformly from the entire surface of the interior walls of the furnace. In the first instance, the temperature of the electric arc may be excessive for the work to be performed. Experience shows that the heat tapers from that of the electric arc to the saturation temperature resulting at points remote from the arc. The second instance, of a furnace having only side wall elements is a modification of the first furnace, but having its source of heat somewhat more widely distributed. In the third furnace, the same amount of heat obviously is delivered from a greater area and, therefore, more uniformly saturates the entire furnace chamber.

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[*] Limited to the discussion of electric furnaces having metallic resistor elements and to be operated at temperatures not in excess of 2000°F. (1093°C.) Manuscript received August 8, 1922. Presented at 42nd General Meeting, American Electrochemical Society, Montreal, September, 1922.

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The single arc furnace is comparable to a fuel furnace of one burner; the side element furnace to a furnace having side wall burners with no means of distributing the excessive heat at the point of combustion or at the source of heat. The third furnace exactly approaches the ultimate aim of all fuel or electric furnace designers.

Is this theory of heat requiring a source distribution for uniform temperature, actual or only theoretical? A committee of research engineers in studying the types of electric furnaces offered to their company for certain specified work, reported, in part, as follows pertaining to an electric furnace having side wall elements, and to a second furnace having the furnace chamber completely surrounded by source of heat.

"Assuming that the same quantity of heat is to be delivered within the furnace within a given time, it seems possible to draw a very interesting conclusion as to the two types of furnaces. Radiation takes place by virtue of difference in temperature between the bodies delivering and receiving the heat; as a matter of fact, in proportion to the difference of the fourth powers of the absolute temperature. In the one furnace we have as effective radiating surface practically the entire inner surface of the furnace, which is approximately 220 sq. ft. (19.8 sq. m.). In the second furnace we have as the initial radiating surface the sum of the sides bearing resistors, which is approximately 95 sq. ft. (8.55 sq. m.).

"By the term 'effective radiating surface' we mean the area of the side of the furnace actually covered by the resistor as a whole, it being our impression that the resistor must be considered as an assembly, and not as individual ribbons or wires.

"The conclusion which we draw is that if a given quantity of heat is to be delivered from each of two radiating surfaces to bodies of the same temperature, and one effective radiating surface is larger than the other, the temperature of the larger radiating surface will be lower than the temperature of the smaller; in other words, to radiate a given amount of heat the temperature of the radiating surface varies inversely with the area of that surface."

The conclusion reached by the committee of research engineers has been proved correct by the temperatures secured in various electric furnaces.

A certain electric furnace in Connecticut has no bottom nor top heating elements. The furnace is used for annealing castings. Temperature control is secured by a Leeds & Northrup automatic control, set at 1500° F. (816° C.). The cycle of operation is of several hours' duration, so that a long period should saturate the load to uniformity, provided the source of heat was not opposed to the laws of light and heat. The source of heat does not surround the charge.

Castings are placed on two trays, one above the other and the temperatures reached in the heating zone have been reported by the operator as follows:

Top of top tray	1454°F. (790°C.)
Bottom of top tray	1382°F. (750°C.)
Top of bottom tray	1346°F. (730°C.)
Bottom of bottom tray	1310°F. (710°C.)

Note that the variation in the charge is 144°F. (62°C.). Since the temperature of the charge varies 144°F., it is apparent that the element temperature is above the set control temperature of 1500°F. (816°C.), or at least 200°F. (93°C.) above the lowest temperature of the charge. In an electric furnace of the exposed element type, with heating elements completely surrounding the charge, bath tubs are being coated with vitreous enamel at 1750°F. (954°C.). Element temperatures are taken by means of small diameter pyrometer couple elements wired in direct contact with the heating elements. The side and top elements with full power applied show 1850°F. (1010°C.) and the bottom elements under cast non-oxidizing floor plates 1920°F. (1049°C.) a difference of only 170°F. (77°C.) maximum between the hottest element temperature and the temperature of the charge, compared with at least 200°F. (93°C.) with the side element furnace.

In contrast to the variation in temperatures of the electric furnace in Connecticut a report has been given regarding another electric furnace, having heating elements completely surrounding the furnace chamber. A glass manufacturer of West Virginia writes as follows:

"We were able to maintain a uniform heat throughout the furnace, both top and bottom, and throughout its length to a range of 1.5° plus or minus. The furnace was operated to a temperature of 1020°F. (549°C.) for the purpose of annealing glass ware. Because of the uniform temperature we were able to have ware so unvarying in quality of anneal as to free us from all anxiety."

In still another furnace having no top nor bottom heating elements 1,000 pounds (455 kg.) of brass tubes were placed, to be saturated to a uniform temperature of 1200°F. (649°C.). The consulting engineer who instigated such test reported that it took five hours and fifteen minutes to saturate the tubes so that the pyrometer couple at the bottom centre finally read the same temperature as other couples placed in the centre of the mass of tubes, at the top of the tubes, and at each side of the mass of tubes.

A second test in the same furnace was conducted similarly, but the stack of tubes was elevated from the floor of the furnace chamber, it being the intention more freely to radiate and convey heat to the under side of the tubes. In this test, in the same furnace as the first test, it required two hours twenty-five minutes to secure uniformity of saturation at 1200°F. (649°C.).

Another test was conducted using a similar mass of tubes placed in another electric furnace, in which heating elements were uniformly distributed on top, bottom and two sides of the furnace chamber. Couples were placed in the same locations as in the first test. Complete saturation was attained in twenty-eight minutes. From the above facts it is conclusively proved that the source of electric heat should be distributed uniformly in order to secure uniform heat irrespective of time cycle of heating.

Relation Between Form of Heating Element and Life of Resistor Element

The form or shape of the heating element has a direct bearing on the life of the resistor element. The choice lies between round elements or flat, so-called, ribbon elements. It can be shown mathematically that the greater area of the ribbon element per weight of section is free to dissipate more rapidly its generated heat than the round element. That is true only in so far as the comparison of elements is concerned, without their relation or adaptability to electric furnace construction. The round element as a furnace element is more practical, and will give greater life than the ribbon element in electric furnace construction.

There is no method of applying ribbon elements so as to take advantage of the greater releasing heat surface. When placed along the walls of a furnace, resource is had to only two methods of application. In one the flat faces of the ribbon are perpendicular to the wall, and in another application the flat face of the ribbon is parallel with the wall. In the perpendicular position the wide faces of any one strand of the element is directly opposed to the wide radiation surface of the adjacent strand. The heat released by radiation, therefore, reflects the same as light waves from one face to another until a built-up temperature exists, considerably in excess of the furnace temperature.

The heat waves then are forced both to the adjacent side wall and to the furnace chamber. The heat waves directed in such manner to the wall of the furnace tend to saturate the wall of the furnace considerably above the normal furnace chamber. Such heat cannot be freely released until the current is completely cut off or lowered in the furnace elements, because the greater heat transmission is from the hotter to the cooler body.

If the wide face of the ribbon is parallel to the adjacent wall a built-up temperature will exist, becuase the heat released from the face of the ribbon nearest the wall, cannot become effective until a temperature exists greater than the furnace temperature, or greater than the charge receiving heat.

The round element, on the other hand, can be placed in corrugations of the furnace wall, so that the generated heat is directly reflected from the groove of the wall face. The surface of these corrugations can be shaped exactly similar to search light reflectors, and actually throw the reflected heat to the furnace chamber and charge. There is, therefore, no built-up temperature in the resistor element. As the convex tops of the corrugations may extend considerably beyond the heating elements, marked advantages will be secured. The corrugations protect the elements from short circuiting by foreign substances as the elements are in effect imbedded below the wall surface. The corrugations keep the elements in perfect alignment. The face of the wall is free at all times to release stored-up heat, and the corrugated surface may add as much as fifty per cent. to the radiating surface of the wall without enlarging the furnace chamber.

The round element is of greater strength than the ribbon element of equal weight, so that the round element is more susceptible of being permanently formed and kept in original proper alignment.

It is susceptible of easy proof that the round element, under equal furnace conditions will outlast in life the ribbon element. Barring mishaps or accidents, the sole cause of disintegration of a furnace element is due to oxidation. Fortunately, at the present time there are available elements of alloys or metals that will give surprising life in service. However, there is a gradual disintegration by oxidation; no one will claim perpetual life in such use.

Relation of Weight of Elements to Performed Work

Compare two typical element sections. The cross-section area of No. 1 round wire is 0.0656 sq. in. (0.426 sq. cm.). A flat or ribbon element of No. 11 B. & S. gauge, 0.091 in. (0.231 cm.) thickness, and having the same area as the No. 1 wire, would be 0.7209 in. (1,831 cm.) wide. The circumference of No. 1 wire equals 0.9079 in. (2.306 cm.). The perimeter of the ribbon element equals 1.6238 in. (4.124 cm.). Therefore, the ribbon element has 0.7159 sq. in. more area per inch of length or 78.85 per cent. more area exposed to oxidation than No. 1 round wire of the same weight.

Assume that the No. 1 round wire and the ribbon element, 0.7209 in. wide by 0.091 in. thick, oxidized to the same depth of 0.005 in. of oxidation. The No. 1 wire would be decreased to 0.279 in. diameter, an area of 0.0612 sq. in. or a reduction of only 6.71 per cent. of area. The ribbon would be reduced to 0.7109 in. wide by 0.081 in. thick equal to 0.0576 sq. in. of area or a reduction of 12.19 per cent.

In a furnace operating two and a half years at temperatures varying from 1200°F. (649°C.) up to 1650°F. (899°C.), it was found by micrometer measurement that the original diameter of the elements 0.204 in. diameter had been reduced to 0.201 in. This furnace had elements surrounding the furnace chamber. If the same furnace had had the elements only in the side of the furnace chamber the decrease by oxidation would have been greater on account of the higher temperature that would have existed in the elements to deliver the same quantity of heat.

Increasing the diameter of a round wire so that the weight is doubled, causes an increase of only 41.6 per cent. of oxidizing area. A No. 1 wire is double the weight of a No. 4 wire, yet 123.7 amperes in a No. 1 wire will release as much heat as 87.5 amperes in a No. 4 wire; or, increasing the weight per foot of round wire 100 per cent. requires only 47.2 per cent. increase of amperes or current density to produce the same quantity of heat. As the weight of the wire has been doubled, it is obvious that the temperature of the source of heat must be lower.

From the foregoing, it is evident that the relation of the weight of the elements to the work to be performed is of vital importance.

The cross-sectional area of the weight of the element should never be sacrificed so as to be used on any line voltage available, but rather the furnace voltage should be made suitable to the furnace element requirements. The weight of the element should be kept constant, irrespective of whether the line voltage be 110 or 220 or 440 volts or higher. It being true that a certain total weight of element is most advisable for performing a certain piece of work, then it becomes impossible to change the weight of that element for adoption of any line voltage without the sacrifice of the ultimate life and efficiency of the furnace.

Exposed element furnaces especially should have low voltage as a safeguard to the operator. Some furnaces, owing to their size, might have their elements figured for a line voltage, but it is of doubtful expediency to operate any exposed element furnace on any voltage that might prove harmful to the operator. It is far more advisable to reduce the furnace voltage to a safety point. The low voltage furnaces are unquestionably advantageous, because the dielectric strength of refractory materials at high temperatures is questionable.

The relation of the weight of the heating element to the work to be performed is of just as much importance as the current density of any element is to the life of the resistor element. An increase of the total weight of element in a furnace permits of the release of the same quantity of heat from the source at lower temperature. Likewise, the temperature of the heating element is lowered in direct proportion to the increase of the weight of the element to the work performed. It is obvious that a required quantity of heat can be released from any given total weight of heating element, so long as the element retains its form. Ten pounds of heating element may be made to operate at a sufficient temperature to release the same amount of heat as 100 pounds of heating element. It is obvious that under these conditions the temperature of the 100 pounds of heating element will be much lower, in fact almost inversely proportional to the weight of the element. The furnace designer, therefore, should not undertake to decrease the weight of the element for any reason. If he does, it will be to the detriment of the life of the furnace element.

No set rule, however, can be established governing the relation of the weight of element to the current density of the element. The current density required is controlled, in part, by the thermal efficiency of the furnace, and the thermal efficiency is a matter of mechanical design in combination with proper selection of the heat insulating material. For example, if an electric furnace has to deliver 50 kilowatts per hour of effective heat and the radiation loss is 10 kilowatts per hour, the element of that furnace will require lower current density and consequently operate at a lower temperature than in another furnace designed for the same work and having the same weight of heating element, but having 30 kilowatts per hour loss. Any difference of thermal efficiency, therefore, has to be accounted for by a rise of temperature in the element to overcome the excessive radiation loss.

The heat insulation, in addition to controlling the current characteristic of the heating element somewhat, also actually controls the result required. Certain desired heating cycles, such as one of moderately quick heating and quick cooling, may be defeated in a furnace by an excessive amount of heat insulation.

The thermal efficiencies of electric furnaces, such as are offered on the market at the present day for operating temperatures of 1600°F. (871°C.), vary from 50 to 90 per cent. thermal efficiency. A furnace in Ohio, having elements on top, bottom and two sides of the furnace chamber is being operated continuously at 1600°F. (870°C.) and shows a thermal efficiency of 88.9 per cent. The thermal efficiency of a furnace may establish its success or failure.

FIELDS OF PAPER RESEARCH

Some observations by C. F. Cross on research and industry are of special interest to paper technologists. Research according to him has many aspects and takes many forms—personal and corporate. The "research" career is full of incalculable elements, and cannot be usefully discussed. Corporate research in relation to industry has the two objectives: technical progress and control of manufacturing routine. Incidentally it creates a moral atmosphere, stimulating and encouraging the personal progress of the workers.

Papermaking involves—craftsmanship of a high order, which, though in essence empirical, is much developed by science; and economic management of the mill, which must be based on exact knowledge.

The mill laboratory and its scientific personnel are an "intelligence department," and should be closely co-ordinated, as such, with the commercial management.

Research in papermaking follows the main lines of progress in exact knowledge:

(a) "Cellulose" and the field of pure science connoted by the term, which includes the physical chemistry of colloids.

(b) Raw materials; the fiber colloids; their economic treatment for half stuff; the recovery and utilization of by-products; the exact determination of the "invisible loss" in working up half-stuff into paper.

(c) The beater as a highly complex operation involving mechanical, physical and chemical factors; which require separate investigation so that the integral result of whole-stuff preparation may be estimated in terms of the contributory factors. As this is the main operation of the papermaker, and as this remains very much a matter of craftsmanship and empirical control, much progress may be expected to follow a really systematic investigation.

(d) The paper machine is obviously an engineering problem, and in the nature of things, the ordinary worker is excluded from this as a field of research.

(e) But in paper qualities—the characteristics of the finished product, and these in relation to uses and commercial values—there is an endless field of research work involving exact method.

Under the above headings the few notes were developed on a survey of the most recent developments, giving indications of the most valuable lines of research towards scientific, technical and industrial progress respectively.—"Paper" (New York).

"FACTICE"—A RUBBER SUBSTITUTE

The product formed by combining sulphur chloride with any of various vegetable oils is called "factice." It is free from sulphur chloride, sulphur, and from the original oil. Factice is often called "rubber substitute," and has been used for hospital sheetings, automobile tops, etc. This substitute cuts down the use of extensive solvents, such as gasoline, benzol, coal tar, etc., and promises to be used in America extensively in many instances where rubber is needed.

Chemical Society News

Containing Official Announcements of the Canadian Institute of Chemistry.

SPECIAL INSTITUTE PRIZE FOR ARTICLE ON CHEMISTRY

As an incentive to members and students of the Canadian Institute of Chemistry, resident in Canada, prizes, amounting to $75 have been created by three Institute members, for the best two articles accepted for publication by any Canadian magazine, national in scope and of a business or literary nature.

The nature of the article should be such as will handle the part played by industrial chemists or chemistry in industry, or everyday life, in a way which will tend to picture more definitely, and stress the potential possibilities of the function of the modern chemist in industry, either in the minds of the public or executives.

The first prize will be $50, and the second $25. Accepted articles must contain at least 3,000 words. The competition will close May 1, 1923. Those wishing to take part in this competition will present to the Secretary 3 copies of the article proposed, and a certified statement from a publisher that the article has been accepted for publication, within a definite time. Prize winners will be decided by a committee appointed by the Council of the Institute.

OPENING MEETING, STUDENTS' BRANCH, C.I.C. KINGSTON

The Student Branch of the Canadian Institute of Chemistry at Queen's University, Kingston, is off to another good start this year. They held their organization meeting on October 10th. The whole student body in chemistry, in both Science and Arts Faculties, are using the organization of the Institute for the purpose of bringing speakers and getting acquainted with industrial and professional matters. In the work, all members of the staff are co-operating.

The secretary, Mr. L. E. Westman, was in attendance at this meeting, and reviewed the work of the Institute to date, pointing out the various lines of activities which would be of value to undergraduates.

Prof. A. C. Neish encouraged the students to take an early interest in Institute affairs, pointing out that, in this way, they would come in touch with affairs of the greatest importance to chemistry in Canada. Practically all men in the upper years are joining up with the branch.

The establishment of a Central Ontario Branch of the Institute with headquarters at Kingston, is being given consideration.

B.C. CHEMIST WRITES OF TECHNICAL PROBLEMS IN DAILY PRESS

The Canadian Institute has been urging members to write articles for the daily press.

Mr. H. Freeman, F.C.I.C., Vancouver, has undertaken this work for "The Daily Province." A series of four articles has appeared, under the general heading "B.C.'s Technical Industrial Problems." Mr. Freeman has undertaken this work because of the real opportunity it presents to influence industrial affairs and developments along sound lines; and he is, we believe, drawing his cheque regularly for the effort. Large papers prefer to pay something, and are remarkably suspicious of free contributions. With such a good start made, it may be that others will be prompted to see what they can do. With a chemist attached to every large Canadian daily paper as a technical or science writer, it would make quite a difference in the amount of good scientific publicity gained for chemistry, and chemically-developed and controlled industries in Canada.

TORONTO SECTION, SOCIETY OF CHEMICAL INDUSTRY

Few speakers have been listened to with greater interest at meetings of the Toronto Section, Society of Chemical Industry, than was Dr. L. V. Redman at the October meeting of the Section, held at Hart House, University of Toronto, Friday, October 20th. As stated by the chairman, Mr. L. E. Westman, in his opening remarks, Dr. Redman needed little introduction to a gathering of Canadian Chemists. He is one of several graduates in chemistry from Canadian universities who have accomplished a great deal of brilliant work in the United States.

The field that early attracted Dr. Redman was that embracing phenol condensation products, and it is by his work in this field that he has won such notable success and has brought honor to his alma mater, the University of Toronto.

The many industrial applications of phenol condensation products as developed by Dr. Redman led to the formation of the Redmanol Chemical Products Co., which has recently been amalgamated with The Bakelite Corporation, General Bakelite Co., and The Condensite Company of America. The Electroplax Company, Limited, with factory at Mount Dennis, near Toronto, is associated with these American companies, and is under their technical supervision.

Dr. Redman prefaced his discourse on phenol condensation products with some general remarks relating to chemists and research opportunities. The only reason, he stated, why he had gone to the United States after graduation was because the industrial opportunities "across the line" were at that time much greater than in Canada. That was ten years ago. Ten years hence, he declared, this would be reversed, and opportunities for chemists would be greater in Canada than in American cities. This was due to the fact that Canadian industry was just now on the threshold of an era of wonderful development, and in ten years' time, Dr. Redman predicted that instead of graduates striving for opportunities for employment, that Canadian universities would not be able to turn out chemists fast enough to keep up with openings awaiting them.

While this was all very cheerful and optimistic, Dr. Redman laid down certain fundamentals that chemists must observe if they desire to win success either now or in the future. First, they must not be afraid of work, and secondly, they must be prepared to work anywhere at the start. The very best thing a chemist could do upon graduation, was to take a job "out in the plant," where he would actually make the product with his hands that he hoped later to have the technical supervision of. And he should work in the plant, not for a few days, but for three or four months until he had followed the process through every operation and knew exactly what happened at every step. He needn't worry about having to stay in the plant, he would, by his superior intelligence and educational equipment, naturally step out of the plant in a few months into the laboratory.

Then there was no reason why he should remain solely in the laboratory. The chemist should have and will have in the future, as he has now in several large concerns, a place at the Board of Directors. Executives were coming to see the wisdom in having their technical superintendent on the directorate, and logically, the very best sales manager a company could have would be a man who had occupied the position of chemist, and this had actually been proven in more than one large American concern. So it follows that a chemist who really wants to advance should familiarize himself with the business side of his industry as well as the technical. The added knowledge certainly wouldn't hurt him, and might be the means of placing him in a very responsible and well paid executive position.

These opening remarks of Dr. Redman proved so stimulating that one almost regretted that the entire evening could not e given over to more of them along the same line, but there was no real cause for regret, however, as his talk on Phenol ondensation Products was most interesting indeed. Dr. Redman first drew attention to the remarkable development that had taken place, particularly in America, on the five great plastics. These were hard rubber, soft rubber, fibre, celluloid. and phenol condensation products.

The outstanding and most useful property of them all was that they were insulators. The amount of plastics in use was remarkable. Every day there were more than 600,000,000 pounds of rubber rolling over the roads in the form of tires. Over 60,000,000 pounds of cold molded plastic are made yearly in the United States. Into phonographic records alone went over 60,000,000 pounds yearly. The cellulose acetate industry had not been so successful as yet, but fibre was sold daily by the carload.

It seemed strange, said Dr. Redman, that with such well known plastics as hard and soft rubber and fibre on the market, that a new one such as the phenol condensation products could make their way. But the reason was that there were industrial applications for which none of the plastics were as suitable as the phenol products. The automatic telephone, for example, would be almost impossible without the use of the condensation products.

Coming to the properties of the phenol condensation products the speaker mentioned two in particular as showing advantages for certain applications over rubber. There was no "cold flow" to the condensation products which was a most valuable asset. Rubber would warp under pressure and in certain places where wet or damp conditions prevailed, but the phenol products showed no trace of warping under similar conditions. This was due to the absence of "cold flow" and this same property was most valuable where quick production was wanted.

The other prominent factor mentioned was the absence of any "tiring effect" for phenol condensation products. This was readily found to be the case by subjecting the products to a test whereby a continuous hammering was maintained for a lengthy period. Absolutely no sign of wearing or what is termed by metallurgists as a "tiring" was in evidence. This quality was very valuable, as it was the chief reason why gears made from phenol condensation products have been used with such success in many plants.

Dr. Redman had a number of interesting samples of these products with him for inspection, including a gear, telephone receiver, insulating strips, and different pieces of electrical equipment.

In conclusion, Dr. Redman dealt briefly with the chemistry involved in the manufacturing of the phenol products. It was purely a catalytic reaction, very readily started, but which required a great deal of care in controlling, as it was very easy to get "too little" or "too much" of either of the principal ingredients, phenol and formaldehyde. He personally preferred the use of hexamethylenetetramine in place of formaldehyde, as it was easier to handle. The process consists chiefly in mixing definite proportions of these two ingredients, using, for example, eight of phenol to six of formaldehyde or hexamethylenetetramine.

The individuality of this resin seemed probable, because it was formed without regard to the proportions of ingredients, and gave identical properties by all methods of manufacture.

Various fillers are used, depending on the density required in the product, and its general use. A empirical rule regarding fillers was that the ratio of filler and resin should be that which would occupy the natural air space in the filler under normal pressure.

An interesting discussion followed the address in which several members took part, including Dr. Lash Miller, Dr. F. Allan, Professors Bain and Ardagh, and Messrs. E. T. Sterne, D. Huether, and W. Thom. Replying to an enquiry regarding the moulding of the products, Dr. Redman said that calcium soap was used as a releaser from the mould. Another query as to the use of the condensation products for making billiard balls brought the information that a considerable business is done in these, about 4,000 per month being made. They were found by actual test to be superior to the ivory ball for wearing qualities, though some players thought their "bounce" too much.

The address was preceded by the usual informal dinner. Over sixty members and guests were present.

EXECUTIVE OF QUEEN'S BRANCH, CANADIAN INSTITUTE OF CHEMISTRY

Following is a list of the Executive of the Queen's University Student Branch, C. I. C., for the year 1922-23:—Hon. president Dr. J. Waddell; chairman, R. H. F. Manske; Vice-president, W. E. Patterson; Sec.-treasurer, D. S. Pasternack; Committee, Prof. A. F. G. Cadenhead and L. E. R. Stevens.

GOVERNMENT CHEMIST WANTED

4606. A Junior Chemist, Ore Dressing and Metallurgy Division, Department of Mines, Ottawa, Ontario, at a salary of $1,680 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $2,040 has been reached. This salary will be supplemented by whatever bonus may be provided by law.

Duties.—Under direction to make chemical analyses and physical examinations of substances, following prescribed methods of analysis; and to perform other related work as required.

Qualifications.—Education equivalent to graduation from a university of recognized standing with specialization in chemistry; at least one year of post graduate practical laboratory experience; in connection with the analysis and assay of ores, concentration, and reduction products; speed, accuracy; good physical condition. While a definite age limit has not been fixed for this competition, age may be a determining factor when making a selection.

Examination.—A rating on Education and Experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify, an oral examination may be given, if necessary.

Application forms must be filed at the office of Civil Service Commission, Ottawa, not later than November 9th. Forms may be obtained from officers of Employment Service of Canada or from Secretary of Commission, Ottawa.

TRANSLATION OF THE BRITISH PHARMACOPOEIA INTO CHINESE

The London Chamber of Commerce have been in communication with the British Chamber of Commerce in Shanghai relative to a proposal that the British Pharmacopœia should be translated into Chinese, which, it is believed, would, if carried out, be of great advantage to the medical profession, and also to British trade in China. The Chemical Trade Section of the Chamber appointed a special committee to consider this proposal, and that committee have reported that, in their opinion, it is advisable that an abridged edition of the British Pharmacopœia should be translated into Chinese, with therapeutical notes as an appendix. Action is being taken accordingly, and in order to meet the necessary expense of translation and publishing, the committee has instituted a fund to which, so far, nearly half the amount required has been subscribed, and an appeal for further guarantees is being issued to the British manufacturing houses directly concerned.

The United States Bureau of Mines, through its Precious Metals Station at Reno, Nevada, is making every effort to discover new sources of rare metals as it is known that many of the precious metals exist only in inadequate quantities. During a recent month no less than 87 samples from ten states were examined for their mineral content.

New Books Reviewed

"The Examination of Hydrocarbon Oils and Saponifiable Fats and Waxes"

By D. Holde (Translated by E. Mueller), 2nd English Edition. 550 pp. Wiley & Sons, N.Y., $6.00.

This work has been found very valuable in the original German, and this second English edition shows an almost complete revision of the text. Both in tables and reading matter, the work is condensed, but not beyond the point where the average chemist will be led astray by lack of detail. Under general methods of examination, are listed all ordinary physical and chemical tests. Some of them may not be commonly used in America, and the book is rendering a service in their introduction. In the Section on petroleum and petroleum products, the portions relating to lubricating oils will be of most general value. The section on vegetable and animal fats is up to date and very complete. The whole work gives the impression of balanced, concise and complete treatment.

There are evident indications occasionally, showing how the lack of raw materials affected German standards and methods during the war. On the whole, we believe this book may be used to good advantage, and can be recommended particularly to those who have any volume of such work in their laboratories. Users will find something on commercial products of all types likely to be met with.

"The Origin of Spectra"

By P. D. Foote and F. L. Mohler. Chemical Catalog Co., N.Y. $4.50

Some day we may have a statement from a competent source, showing how it came about that chemists left so much of the speculative work relating to the ultimate nature of matter to the physicists. Undoubtedly a meagre knowledge of mathematics had much to do with it. Time was when molecules and anything less were left entirely to the chemist. More recently, however, he has been left far behind in the race for theories relating to the inside of the atom. Now we are at a stage where the chemist is very much interested, because, being of a commercial turn of mind, he believes that ultimately there may be money in some of these theories, and also a few chemists are learning the language of mathematics, even if it be only from a strictly utilitarian standpoint.

The result is that they are being presented with books which 99% of them cannot read, and if the result is a net gain of even 10% in reading ability, the effort will not have been vain. Close students of the subject matter outlined in this work will still refer to the original papers upon which it is based, but those who wish seriously to become even relatively well-informed will find that the author has held some of the vista long enough for the slow-plodding chemist to see it. Our wish is that all chemists were good enough physicists to read the work with pleasure and profit.

Seriously, however, the experimental nature of work done, either in support or otherwise of various theories, is within the grasp of chemists. This data will remain with us. Sound conclusions and practical applications might be more readily arrived at if a larger number of chemical research workers were interested in the field and really more familiar with it.

"American Fuels"

By R. F. Bacon and W A. Hamor. 2 vols., 1,200 pp. McGraw-Hill Co. Price $12

The two volumes are in reality a series of connected articles on general and special topics, written by men of experience in the field covered.

Volume I. covers the coals of the United States; the principles of combustion; the technology of coke; briquetted fuels; an economic review of coal preparation; the gasification of fuels;

low temperature distillation; and pulverized fuel. Each chapter is undoubtedly well written, and the combination is impressive, as the method avoids the difficulty met with by a single author, who may struggle with a topic upon which he is not an expert.

The question of coal preparation as a broad economic necessity is well treated and timely. True economic utilization rests in the hands of those who are now the largest coal users, and the review presented is, therefore, well placed. Comparatively speaking, these books should rank high as standard references to present practice. They are well illustrated, without becoming catalogs.

Volume II. introduces special subjects, such as mechanical stokers, fuel oil, colloidal fuel; natural gas, and various derived gases; heat application and the relative thermal economy of electric and fuel fired furnaces. The volume is completed with some well stated considerations on conservation and economic power practice, along with the presentation of problems in fuel utilization and the petroleum industry. Methods for testing fuel oils and specifications complete the work.

These two books make an excellent set of references, and can be recommended to fuel engineers and chemists. The latter perhaps should know more than they do in some cases about such practical and important industrial operations, whenever called upon for advice on such matters they will find these books presenting well-balanced discussion and information.

WORLD CONDITIONS AND NEWS IN CHEMICAL FIELDS

(Special Correspondence to CANADIAN CHEMISTRY AND METALLURGY by our London Representative)

English Chemical Market

Heavy chemicals have a slightly greater demand than formerly, but it is doubtful if trade in fine chemicals will increase until there is a stability in exchange rates. The demand for home consumption remains the same.

The production of sulphuric acid in the United Kingdom has increased from fifty to sixty per cent. of the plant capacity. During the first six months of the year, 197,000 tons of pyrites were imported, mostly from Spain.

Ferromanganese

Ferromanganese still has a ready market in the United States, though both the English and foreign demand show a decrease. Wolfram has become exhausted, which leads us to believe that the price of ferro-tungsten will advance in price.

European Iron and Steel Situation

It is the belief among steel manufacturers that the low level in iron and steel has been reached, and that from now on there should be a greater demand for this necessary material in shipbuilding and all engineering and industrial lines.

The changes in the steel market of Europe are interesting to note. Before the war, 30,000,000 tons of steel were produced annually. During the war, steel was largely consumed in the manufacture of munitions, but since 1918, only 15,000,000 tons can be produced, although the demand is for 200,000,000 tons. This will be used in railroad extensions, and the manufacture of farm implements and machinery. The United States with one quarter the population is producing twice the amount of steel. France, Germany and Belgium can not nearly supply the demand. The French, aided by the Belgians and other continental steel producers can only supply 10,000,000 tons, while Germany's capacity is the same, leaving a shortage of 40,000,000 tons. The market is open for British enterprise. The need of South America is equally great, where 6,000 miles of new railroad is needed immediately.

French and German Steel

The total iron resources of France are estimated at 5,500,000,000 metric tons, and of Germany, 1,270,000,000 metric tons. The French recovery of Lorraine accounts to some extent for the difference in the steel resources of the two countries. A French miner produces 64.1 metric tons monthly and a German 109.7 metric tons monthly.

The iron and steel manufacturers of both countries necessarily meet to discuss their own industry and a Franco-German steel trust is now planned.

New Steel Thermal Treatment

Crosley, Lockwood and Son have issued a new book, "Steel Thermal Treatment," by J. W. Urquhart, which deals with the production of machinery, generators, steam turbines, tools, etc., and also gives space for laboratory work on the treatment of steel by heat.

World's Lead Supplies

There have been no new lead districts discovered in the last decade, and yet the demand for this product is constantly increasing. The storage battery, which is in such demand for automobiles and radio outfits, and paint industry alone are capable of using one-half the total lead production.

The United States, Australia, Mexico and Spain are probably the chief producers of lead. The Australian production is under Government supervision and cannot be produced in large quantities at former low prices. Germany is competing strongly with England for Australian lead and concentrates which may have a serious effect on Britain. The price of lead will probably remain relatively high during the next decade.

The Production of Spelter

From statistics available, the output of Spelter has dropped so that in 1921 the production was only about 40% of that of the year previous to the war.

Naphthalene Motors

Naphthalene as a fuel is creating wide interest, owing to the high prices of petrol and benzol. Its cheap manufacture and intense heat value combined with the tests it has withstood have aided the installation of naphthalene motors in many industrial lines.

New Vegetable Oils

Tomato seed, previously a waste is now utilized for the manufacture of food oil. Oil for the manufacture of soap is being produced from waste grain elevator screenings.

The sunflower is capable of producing many kinds of oil by different treatments. Okis seed produces an oil similar to cottonseed oil. Cohune nut oil can in many cases replace cocoanut oil. Many other oil-producing sources are now only waiting development, among others the grape seed which has developed extensively in Germany during the war.

The Castor Oil Plant

The United States require a million bushels of castor beans yearly, and out of the oil produced, only a quarter is used for the various departments of pharmacy. Considerable is used in the manufacture of soaps, and is the best lubricant for aeroplane motors.

With such an extensive field, the castor oil plant could profitably be developed more than it has in the past. It requires much cultivation, but as the leaves are not liked by stock animals its cultivation would not interfere with grazing.

Ammonia Bicarbonate

Dr. W. G. Gland, a German chemist, has made a careful study of the industrial value of bicarbonate of ammonia, following up the interest taken of late in this chemical. He has obtained many interesting facts of its use as a fertilizer and compares its value with that of other well-known cultivaters. The subject has also been freely discussed among English experts.

Indian Rubber Industry

Raw rubber produced in India amounted to 18,099,160 lbs. in 1921, as compared to 27,400,000 lbs. in 1920. The rubber of India is chiefly grown in Southern India, Burma and Assam. There was a decrease of 21% in the export of rubber during 1921-22, compared with the previous year.

INDUSTRIAL DEVELOPMENTS

St. Johns, N.B.—The Nashwaak Pulp and Paper Company, Ltd., is increasing the capacity of its plant from 60 to 80 tons of sulphite pulp per day. New improvements include a boiler system, Jenssen acid system, new screens and modern improvements to their drying system.

Welland, Ont.—The Welland Packing Company, Ltd., capitalized at $100,000, has purchased a site in Crowland township, and are erecting a plant. It is expected that the plant will be in operation early in December.

Port Arthur, Ont.—The Minnesota Forests Products Company have purchased 66,500 acres of timber and surface rights on Isle Royale, from the Island Copper Company. Development work is to start at once, the copper company to work the copper deposits and the Minnesota company to take out timber.

Owen Sound, Ont.—The McQuay Tanning Co. have increased their plant about fifty per cent., by the erection of a three storey building.

Montreal, Que.—The Montreal, Campbellford and Frankford plants of the Canadian Paper Board Co., Ltd. will gradually have new equipment added, which will increase the company's output.

Leaside, Ont.—The Durant Motors of Canada, Ltd. are adding two manufacturing buildings to their plant at a cost of $1,000,000. These will be used to manufacture their new Star car, and also the A22 Durant model.

Merritton, Ont.—The Lincoln Paper Mills Co., Ltd., have transferred all their property and business to the Lincoln Mills, Ltd. This includes the fixed properties of the Canadian Pulpwood Corporation, and 280 square miles of virgin spruce timber in Gaspe Peninsula, and the mills and operating equipment of this corporation.

Hamilton, Ont.—The Canadian Drawn Steel Co., Ltd., have, during the past year installed new and expensive equipment for the manufacture of cold drawn steel.

Coniston, Ont.—The Mond Nickel Co. are showing increasing signs of activity, having lately shipped thousands of tons of matte to their refinery at Swansea, Wales.

Collingwood, Ont.—Plans for the erection of a new tannery, which will be the first in Canada to make use of the Nance tanning process, are under way.

Lakefield, Ont.—The Canada Cement Co., Ltd., are making arrangements for the development of electrical power from surplus heat, in the alterations at their plant.

Asbestos, Que.—The Canadian Johns-Manville Co. will shortly build two steel and brick buildings for the manufacture of asbestos roofing, pipe covering, packing, asbestos shingles, brake band lining, etc.

Calgary, Alta.—The Imperial Oil Co., Ltd., are constructing a refinery on an hundred and eight-acre site at a cost of $2,500,000.

Merritton, Ont.—The Hayes Wheel Co. of Canada, Ltd. have bought the factory of General Forgings and Stampings, Ltd., at Merritton for the production of outside automobile rims.

Elko, B.C.—A large plant is being erected for the Wigwam Pulp and Paper Co. and is being financed by a syndicate of Canadian and American newspapers. The first unit of the plant will cost approximately $3,500,000, while the other two units will cost together, $13,000,000.

New Westminster, B.C.—The manufacture of paper will commence at the plant of the New Westminster Paper Mills early in November.

Ridgeville, Ont.—The Ridgeville Concrete Works and Fonthill Concrete Products will start manufacturing sewer pipe, drain tile, brick, blocks and other cement products, this fall.

Toronto, Ont.—National Fruit Products Co. have been formed for the manufacture of Jel-a-Fruit. The company will incorporate for about $50,000.

Winnipeg, Man.—The Central Canning Co., Ltd. have postponed operations till next year.

CATALOGS RECEIVED

Chemical Engineering Catalog—The Seventh Annual Edition of this well-known work is now off the press and under distribution. Since its first appearance in 1916, this catalog has proved its value to many hundreds of engineers, chemists, business executives, and directors of laboratories throughout the United States and Canada. The word "catalog" is probably the best word that could be given to this work, and yet it does not convey fully the immense amount of information contained in its 1187 pages. It is not a "catalog," as the word "catalog" generally implies. It is really a reference work for chemical engineers, works managers, purchasing agents, operating engineers and others who buy and specify equipment and materials in the various industries using chemical processes of manufacture.

The first section of the book consists of a classified directory of equipment and materials. The particular kind of equipment or product is listed with the manufacturers' name beneath. This directory is arranged alphabetically.

Then follows 733 pages devoted to firms manufacturing equipment of various types. Each company has at least a page, showing detailed description of their product. This section is beautifully illustrated.

The next 114 pages comprises the chemicals and materials section, where data is given concerning the products of leading manufacturers of chemicals, reagents, raw materials and supplies used in the various industries using chemicals. The work is concluded with a technical and scientific book section, giving an excellent list of books in English dealing with chemical and allied subjects.

The catalog is published by The Chemical Catalog Co., 19th E. 24th St., New York, and the leasing fee to those in industrial or university fields is $2.00 per annum.

Dopp Seamless Jacketed Kettles, Mixers, etc. Catalog VII.—Chemists, engineers and superintendents of plants where the use of kettles, mixers, or vacuum and pressure apparatus is required will find in Catalog VII, recently issued by the Sowers Manufacturing Co., Buffalo, N.Y., a very handy book of reference. Dopp equipment has earned for itself a high reputation in many plants in the United States, and in quite a few in Canada. Undoubtedly the secret of the success attending the use of this equipment lies in the efficient, scientific and careful way in which the manufacturing of the apparatus is carried out. The catalog gives an insight into these methods of manufacture among which the most important is the one-piece construction. No rivets, bolts or welds are used in the construction of Dopp Kettles. The entire unit is cast without seams or joints, eliminating any possible chance of leaks. A special process by which the iron does not come in contact with the moulding sand produces a kettle of smooth surface without necessitating grinding, which destroys the wearing qualities of a kettle. The iron used in Dopp kettles is a special mixture, developed from years of experimenting. It is high in silicon, low in manganese and phosphorus, ductile, 35,000 to 40,000 tensile strength and machines sharp and clean. Each kettle turned out is tested to 150 lbs. hydrostatic pressure, special kettles are also built for higher pressures. A feature of the catalog is the illustrations of the different equipment which show the pieces complete and in cross section. Besides the steam jacketed kettles, oil jacketed types and types equipped with agitators are described, as well as special equipment. Dopp equipment is being used in over fifty branches of industry, including explosives, dyestuffs, food products, textiles, packing houses, varnish, soaps, and confectionery.

Canadian Link Belt Co., Toronto.—A new general catalog, No. 400, is announced. It is the largest the company has ever issued, containing 932 pages of illustration and description. The products of the H. W. Caldwell & Son Co., now associated with Link-Belt, are included. Some 200 pages are devoted to Link-Belt Chains and Wheels. New lines are the Helicoid Screw Conveyor and Machine-Moulded Gears. The company is manufacturing Power Transmission machinery, bearings, elevator boots, buckets, conveyor gates, apron and belt conveyors, boiler plant equipment, coal handling and washing equipment, car loaders, portable loaders, locomotives and crawler type cranes, electric hoists, sand and gravel washing equipment, lime handling equipment, special elevators and conveyors for glass, canneries, freight, sugar plantation and refinery machinery. This is the most complete and valuable source of information on such equipment ever issued by this company. It is offered free, on request, to chemists and superintendents.

New Edition of Thomas' Register.—Thomas Publishing Co., New York, Canadian Agents, The Canadian Buyers Register Co., 91 Constance St., Toronto.

The thirteenth annual edition of Thomas' Register of American Manufacturers has just been published, being 4,500 pages in size, cloth bound, and while listing only the products and raw materials from United States sources of supply, is used by nearly 700 purchasing agents and buyers for Canadian concerns. The book is divided into three main sections.

Over 300,000 makers of 70,000 articles or products are listed in the first section, there being, for example, 2016 kinds of machinery classified, with the names of the makers of each kind given. There are ninety-nine kinds of acids classified, 258 kinds of brushes, eighty-three kinds of leather, 119 kinds of pins, sixty-three kinds of soap, 242 kinds of valves, sixty-five kinds of wax, etc.

In another section all the manufacturers are listed alphabetically, with addresses of head and branch offices, officers of the company, etc. An exclusive feature is the capital rating showing the size of each concern, giving the reader knowledge whether the firm is a hundred million corporation or a small forty thousand factory with limited capacity.

A third section lists 50,000 branded articles with the names and addresses of the makers of the trade name products. There is also a list of exporters and importers, with a directory of banks, commercial organizations and trade publications.

The New Building Estimator's Handbook. by Wm. Arthur. The U. P. C. Book Co., New York; 100 pp. $6.00.

This is a practical book, largely used by builders, and would make an excellent guide in the checking-up of work under contract or in cost estimation. Particularly valuable to the man who desires a working knowledge of general building construction and may be called upon to give an executive opinion of such work, or make general estimates of cost.

BRITISH COLUMBIA INDUSTRIAL NOTES

The Union Oil Company has completed its warehouse and oil-storage plant at Nanaimo, on Vancouver Island. The plant consists of a large corrugated iron warehouse, and five steel tanks, three having a capacity of 15,000 gallons and two 13,000 gallons. A spur has been built to connect the plant with the Nanaimo and Esquimault railway.

The shareholders and directors of the Gregory Tire & Rubber Company of Vancouver are suing Morton Gregory, general manager for the company, for the recovery of $100,000 in cash and $650,000 in shares, which was paid to him for patents that the shareholders and directors aver are valueless to the company. The company has a paid-up capital of $1,465,000, and shares are held in all parts of the Province.

LATEST CHEMICAL AND METALLURGICAL PATENTS OF SPECIAL INTEREST

Reported to Canadian Chemistry and Metallurgy by A. E. MacRae, Ottawa

NOTE—Readers wishing further information concerning any particular patent listed below may obtain the same by writing to Patent Office, Ottawa, Canada.

Flotation of Minerals.—A. J. Miller, 222083, Aug. 8, 1922. In concentrating ores by flotation the metalliferous particles are coated with a thin film of liquid S, which is supplied to the particles in the state of finely divided droplets produced by the coagulating action of an electrolyte on a water solution of soluble S. obtained by the action of H_2S on a solution containing an excess of SO_2 or by the action of an acid on a thiosulfate.

For Reducing Ores.—A. Stansfield, 220988, July 18, 1922. Ores are reduced to the metallic state without fusion by heating a mixture of the ore and carbonaceous material first in a muffle furnace and then in a furnace without a muffle in which a reducing or non-oxidizing flame is maintained. The gases from the second furnace are burnt in a flame tube of the muffle furnace. App. is also specified.

Flotation of Minerals.—A. J. Miller, 222084, Aug. 8, 1922. In concentrating by flotation ores containing metallic oxided or carbonates, a solution containing S in the state of finely divided droplets with an excess of SO_2 is added to the crushed ore, and H_2S is added to precipitate any soluble salts formed and to convert the solution of soluble salts immediately surrounding the remaining particles to a sulfide film.

Flotation of Minerals.—A. J. Miller and J. Kendall, 222061, Aug. 8, 1922. In separating metalliferous sulfides from gangue a water solution containing free Se or Te in the state of finely divided liquid droplets is added to the crushed ore to coat the sulfide particles with a thin film of Se or Te. These coated particles are then removed as a froth.

Flotation Separation of Mineral Substances.—R. D. Nevett, and T. H. Palmer, and H. V. Seale, 222059, Aug. 8, 1922. In the concentration of ores by flotation with an acid, alkaline or neutral solution to which an organic frothing agent may or may not have been added, ½ of 1% of elemental S is added. The values may thus be obtained as a mixed or collective float or as separate or preferential floats.

Decomposing Waste Sulphite Liquor.—K. Morch, 221733, Aug. 1, 1922. Waste sulphite liquor is continuously led through a preheater at 170-200° and thence to a container in which the pressure is 17-20 Kgms. per cm. so as to decompose the liquor. The products of decomposition are continuously removed through a series of vessels in each of which steam is allowed to escape and the steam is led to the preheater.

Process of Making Formaldehyde.—H. R. Von Hochstetter, 221666, Aug. 1, 1922. A mixture of air and MeOH is conducted at a suitable temperature over a catalyst consisting of catalytic substances so that the mixture comes in contact with each of the substances. The catalyst may be a Cu tube containing Aq in suitable form or a catalytic metal associated with a metal of the Pt group.

Metaldehyde.—H. Danneel and E. Luscher, 221643, Aug. 1, 1922.

Treating Filaments for Incandescent Lamps.—J. H. Ramage, 221637, Aug. 1, 1922.

Benzoic Acid Esters of Tribromo Tertiary-Butyl-Alcohol.—T. B. Aldrich, 221449, July 25, 1922. Tribromoter-tiarybutyl benzoate, a stable white crystalline compound insoluble in H_2O and very soluble in organic solvents, M.P. 89°, and not readily decomposed by acids, is prepared by the reaction of BzCl with tribromotertiary-butyl-alcohol.

Esters of Trihalogentertiary-Butyl-Alcohol.—T. B. Aldrich, 221448, July 25, 1922. The benzoic acid ester of trichloro-tertiary-butyl alcohol is of white crystal form, m.f. 34°, may be distilled under reduced pressure with decomposition is readily soluble in organic solvents; insoluble in H_2O, is not readily saponified, is not decomposed with acids, decomposes gradually on boiling with alkali, is not volatile in H_2O but slightly volatile in steam.

Liquefying Chlorine Gas.—Wm. Marshall Jewell, 222996, Aug. 22, 1922. Cl gas is compressed and commingled with H_2SO_4, condensed while so mixed then separated from the acid and dried therewith. The Cl is discharged into containers without air or gas by removing air from the container and introducing the condensed Cl into the container while maintaining the latter at a temperature not exceeding that of the liquefied gas.

Extraction of Copper from its Ores.—R. H. Bradford, 222466, Aug. 15, 1922. Cu. ores having a S content different from the amount which would be chemically equivalent to the amount of Cu and other chloridizable metal in the ore, are mixed with an alkali earth halide in amount equivalent to the Cu and other volatilizable metal in the ore and heated to 800° in a non-reducing atmosphere. The volatilized Cu halide is collected in a dry state and heated with an alkali earth to reduce the fume to metal and to fuse the metal formed whereby alkali earth halide is reformed for re-use in the process.

Aluminum Alloys.—A. de Lavandeyra, 222489, Aug. 15, 1922.

Reduction of Metallic Ores.—D. Wright, 222643, Aug. 15, 1922.

Alkyl Ethers of Starch.—L. Lilienfeld, 222377, Aug. 15, 1922. Alkyl ethers of starch or similar carbo-hydrates are prepared by dissolving the carbo-hydrate in caustic alkali solution and reacting upon it with an alkylating agent such as diethyl sulfate. The ethyl ether of starch is insoluble in H_2O and may be purified by dissolving it in alc and then by precipitating by addition of H_2O or a dilute acid and washing. The product is readily soluble in many solvents.

Flotation Process.—C. Spearman, 222388, Aug. 15, 1922. Graphite ore is ground with an aqua solution containing oil and agitated to cause the flakes with protective adhering masses of particles of graphite to rise to the surface and float, this concentrate is then screened to separate the flakes from the powdered graphite.

Flotation Processes.—E. B. Thornhill, 222407, Aug. 15, 1922.

Aldehyde Ammonia.—F. W. Skirrow, 223598, Sept. 12, 1922. Aldehyde and NH_3 are brought together in a water vehicle and the aldehyde NH_3 formed dissolves in water until saturation when it crystallizes out and may be separated by filtration and the saturated solution is returned to the reaction.

Aldehyde Ammonia.—H. W. Matheson, 223597, Sept. 12, 1922. An aliphatic aldehyde and NH_3 are passed into a solvent (liquid ester) for aldehyde NH_3 and the latter separates out in crystallization form and is filtered off. The temperature of reaction is maintained below 50· by external cooling.

Aldehyde Ammonia.—H. W. Matheson, 223596, Sept. 12, 1922. CH_3CHO vapor and gaseous NH_3 are brought into contact in proximity to a cooled surface upon which the produced aldehyde NH_3 is deposited. The temperature is maintained below 50 by external cooling, and by utilizing the heat to vaporize liquid NH_3 within the vessel.

Manufacture of Mercury Salts.—H. S. Reid and A. H. Maude, 223591, Sept. 12, 1922. Metallic Hg is brought into contact with the desired acid and HNO_3 or HNO_2 is added from time to time to maintain the reaction. The HNO_3 or its equivalent may be regenerated by supplying O or air to the reaction.

WHAT GOES INTO AUTOMOBILES

"The Industrial Digest" (New York) publishes the following interesting figures regarding the consumption of materials by the automobile industry. The figures are for the United States motor car industry, 1921:

The automotive industry uses 1,464,000 tons of iron and steel a year—or approximately four per cent of the total output of the country. 43,250,000 pounds of aluminum were used in 1921 in manufacturing cars and trucks—or twenty-two per cent. of our total output of aluminum. The manufacture of automotive vehicles required the use of 83,425,000 pounds of copper—sixteen per cent. of all the copper mined in the country. One-fifth of all the tin used in the United States is used in the automotive industry—some 12,510 tons a year. The Tanners Council estimates that 54,000,000 square feet of upholstering leather was our 1921 output, and of this amount 37,165,000 square feet were used in making comfortable seats for automobiles and truck passengers. In addition, more than 88,000,000 square feet of imitation leather was used in upholstering (figure that out in acres for yourself).

Although the amount of wood on the average car does not seem to be worth mentioning at first glance, 313,800,000 board feet were used by this mushroom industry last year.

When one speaks of plate glass, one generally thinks of department stores windows, but thirty per cent. of all the plate glass made in the country, or 16,500,000 square feet was used in manufacturing everything from roadsters to five-ton huskies. It required nearly 6,000,000 gallons of paint and varnish to dress up our motor cars last year, and it took 16,000,000 pounds of hair and padding to make comfortable seats. Aside from these items, 6,670 tons of lead, 3,400,000 pounds of nickel, 5,357,000 yards of upholstering cloth, and 15,330,000 yards of curtain material were some of the items in the raw material bill.

AMERICAN POTTERY FIRMS CHARGED WITH PRICE FIXING

Twenty-three pottery firms of the United States have been indicted on a charge of price fixing and unlawful restriction of sales. The indictment is the result of an investigation authorized by the New York Legislature, and was returned by the Federal Grand Jury, but has been held under seal, pending further investigation. The indictment charges that a price-fixing combination was engaged in by the defendants whereby they refrained from competing with one another on a price basis thus exacting "uniform arbitrary and non-competitive prices." They are also charged with engaging in a practice whereby all sales had to be made through so-called legitimate jobbers and were, by agreement, barred from selling their products directly to builders, architects or contractors. The District Attorney charges that in this way prices to the consumer were increased "beyond all reasonable proportions." The jobber, in turn the indictment charges, would confine his sales to a so-called legitimate plumber, who, after adding his profit, would sell to the contractor.

The twenty-three companies indicted, represent eighty-five per cent. of the pottery industry of the United States. Twenty-four officers of the twenty-three companies have also been included in the indictment.

SOCIETY CALENDAR

Thirteenth American Good Roads Congress and 14th National Good Roads Show, Chicago, January 15-19, 1923. The Congress to be held at Congress Hotel and the Show at the Coliseum. E. L. Powers, Secretary, American Road Builders' Association, 37 West 39th St., New York, N.Y.

National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, December 7-13, 1922.

REPORTS RECEIVED

Tenth Report of Quebec Streams Commission. —The Quebec Streams Commission have issued their tenth annual report for the year ending October 1, 1921. During the year, the commission made several investigations respecting the flow conditions of rivers and also carried on further work regarding a hydrometric survey of the province. The revenue received by the commission from companies benefitting by the reservoirs on the rivers, St. Maurice, St. Francois, and St. Anne de Beaupre for the year ending June 30, 1921 totalled $274,646. Each river of the province is reported on as regards flow, hydrometric data, etc. Mr. O. Lefebvre, C.E. is the chief engineer and secretary of the commission.

CANADA'S TRADE ON THE PACIFIC

Canada's foreign trade with certain countries at the close of the 1922 fiscal year was:

	Exports	Imports
Asia (excluding Russia and Turkey)	$21,500,000	$21,500,000
Oceania	15,000,000	5,000,000
Mexico and South America (on the Pacific)	2,200,000	11,700,000

Mr. F. C. T. O'Hara, deputy minister of trade, represented Canada at the San-Pacific Commercial Conference at Honolulu recently.

A small pamphlet of trade figures for the information of delegates to the Conference may be had by subscribers, by applying to the Bureau of Statistics, Ottawa.

Chemical, Oil and Metal Mar ets

November 1st. finds the chemical market in Canadian trading centres in a firm and steady position. As mentioned in our October report the reductions made in many chemical prices have held firmly, and it would seem that for the most part all the heavy industrial chemicals have reached the lowest price at which they can be sold in accordance with present manufacturing costs. Therefore, while there may be some slight variations in price at different selling points due to imported material, yet, on the whole, little if any reduction in prices on heavy chemicals need be looked for, at least during November.

A feature of the market is the advance of all solvents in price, including alcohols, acetone, and formaldehyde.. Formaldehyde and wood alcohol prices are now at their highest since August 1921. There is a steadily increasing demand for wood alcohol both in Canada and the United States, and in American markets the demand is in excess of the supply. Advances of wood alcohols have naturally been reflected on advanced formaldehyde quotations.

These recoveries are merely a sign of the better times in store for all chemical manufacturers, and solvent manufacturers in particular are deserving of better business as the depression of a year ago hit their industry harder than any other branch of the whole chemical industry.

Another feature of the market has been the strong position of white powdered arsenic. During the last week of October the highest price of the year for white arsenic was realized when quotations were 10 to 12c per lb. f.o.b. Deloro, Ont. The 10 cent quotation was only for car lots. Recent buying by the glass, insecticide, and other consuming trades has greatly reduced supplies, and higher prices are anticipated. Conditions are exactly reversed from those prevailing at the beginning of 1922 when buyers passed arsenic by at from 6 to 8c per lb.

Caustic soda, bleaching powder, soda ash, and the heavy acids are all remaining firm in price with absolutely no change from October 1st quotations. The demand from the consuming industries is keeping up well for all the heavy chemicals. There is a good business going in glycerine, all grades. The demand for the pale-straw grade of glycerine for anti-freeze mixtures for motor cars is particularly noticeable just now, and constitutes an important part of the glycerine trade.

METALS

The feature of the Canadian and American metal markets at the opening of November is the strong position of zinc. During October quotations on zinc advanced 45 cents per cwt. and in car lots is now offered at $8.45 per cwt. at Toronto and Montreal. Orders for zinc from manufacturers have increased steadily in volume during the past three months until to-day all zinc distributors are doing a splendid business. The galvanizing trade and the brass foundries are the heaviest purchasers of zinc and they are continuing to buy in good quantities.

The many commodities used by the building trades into which zinc enters, such as galvanized sheets, are largely responsible for much of the zinc purchased. The building and construction trades are the busiest of all Canadian trades at present and have been all fall, and as metals of all kinds enter into articles used in construction work, the increased building activity has had a very beneficial effect upon the metal trades.

Lead, too, has experienced another advance, and at November 1st, was quoted at $6.80 per cwt. in car lots at Toronto.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.50— 5.00
Ammonium Bromide	Lb.	.. — .22
Aluminum Sulphate, lump, bags	Cwt.	2.25— 2.50
Aluminum Sulphate, ground, bags	Cwt.	2.75— 3.00
Aluminium Sulphate, iron free	Cwt.	.. — 4.00
Ammonia, Aqua, 26, Carboys	Lb.	.. — .14
Ammonia, Aqua, 26, Drums	Lb.	.. —.09½
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb	.10— .12
Barium Sulphate (Barytes)	Pre Ton	30.00—35.00
Barium Chloride	Lb.	.05— .07
Barium Nitrate	Lb.	.. — .20
Barium Peroxide	Lb	.. — .26
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	2.75— 3.00
Borax, crystals	Lb.	.07—.07¼
Boric Acid	Lb.	.. — .13
Bromine (technical)	Lb.	.. — .38
Calcium Acid Phosphate	Lb.	.. —.07½
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —[illegible]5.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	..—100.00
Calcium Chloride, fused	Per Ton	.. —25.00
Calcium Chloride, flake	Ton	40.00—42.00
Caustic Soda, ground, drum	Cwt.	5.00— 5.50
Caustic Soda, solid, drum	Cwt.	4.50— 5.00
Camphor Monobromate	Lb	.. — 3.00
Carbon Bisulphide, in drums	Lb.	.11— .12
Carbon Tetrachloride, drums	Lb.	.20— .21
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, Canadian, f.o.b. Huberdeau, Que., car lots	Ton	17.00—18.00
China Clay, imported	Per Ton	20.00—25.00
Cobalt Oxide, black	Lb.	.. — 2.00
Cobalt Oxide, grey	Lb	.. — 2.25
Copperas (Iron Sulphate) crystals	Lb.	.02—.02¼
Copperas (Iron Sulphate) sugar	Lb.	.02—.02¼
Copper Sulphate (Blue Vitriol)	Lb.	.08—.08¼
Corrosive Sublimate (Mercuric Chloride)	Lb.	.. — 1.10
Fluorspar, ground	Tons	.. —30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	35.00—40.00
Ferric Chloride, crystals	Lb.	.11— .12
Ferric Chloride, solution	Lb.	.. — .10
Hydrofluoric Acid, 60%	Lb.	.. — .28
Hydrofluoric Acid, 30%	Lb.	.. — .14
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	.70— .75
Iodine, crude	Lb.	.. — 4.50
Iodine, resublimed	Lb.	.. — 5.25
Iron Oxide (red)	Lb	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.14 — .15
Lime, grey	Ton	.. —14.00
Lime, grey, in car lots	Ton	.. —11.40
Lime (hydrated) in ton lots	Ton	.. —19.25
Litharge	Lb.	.09— .10
Lithium Carbonate	Lb.	1.75— 2.10
Lithopone	Lb.	.06— .07
Magnesite, calcined	Per Ton	25.00—30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl	Lb.	.12— .13
Magnesium Sulphate	Lb.	.03½—.04½
Mag. Sulphate, B.P., Medicinal	Single Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Mica, ground, f.o.b. Hull, Que.	Tou	.. —60.00
Muriatic Acid, 18	100 Lbs.	2.25— 2.75
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt.	Lb.	.. —.16½
Nickel Salt, double, barrel lots	Lb	.. — .15
Nickel Salt, double, per cwt.	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lbs.	8.75— 9.00
Phosphoric Acid, 85%	Lb.	.. — .28
Phosphoric Acid, 50%	Lb.	.. — .22
Phosphorus, yellow	Lb.	.. — .34
Potash Prussiate, yellow	Lb.	.28— .30
Potassium Bicarbonate	Lb.	.. — .20
Potassium Bromide, crystals	Lb.	.22— .30
Potassium Bromide, granular	Lb.	.22— .30
Potassium Bichromate	Lb.	.17— .18
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .09
Potassium Chlorate	Lb.	.. — .10
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .45
Potassium Hydroxide (caustic potash) small drums	Lb.	.10— .15
Potassium Hydroxide (caustic potash) large drums	Lb.	.07— .08
Potassium Iodide	Lb	.. — 4.20
Potassium Nitrate, casks	Lb.	.. — .10
Potassium Permanganate, bulk	Lb.	.19— .20
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. — 9.00
Soda Ash, bags	Cwt.	2.25— 2.40
Sodium Acetate, ton lots or over	Lb.	.. — .08
Sodium Acetate, lesser amounts	Lb.	.. —.08½
Sodium Aluminium Phosphate	Lb.	.. —.03½
Sodium Benzoate	Lb.	.75— .80
Sodium Bicarbonate, 100% pure	Lb.	2.50— 3.00
Sodium Bichromate, bbls	Lb.	.10— .13
Sodium Bisulphite, powder	Lb.	.05¼— .06
Sodium Bisulphite, 35 Be	Lb.	.03—.03¼

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Sodium Bromide (foreign)	Lb.	.. — .24
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. — .31
Sodium Hyposulphite, kegs	100 Lb.	5.85— 6.00
Sodium Hyposulphite, barrels	Cwt.	5.25— 5.50
Sodium Iodide	Lb.	.. — 4.60
Sodium Nitrate, refined	Cwt.	6.75— 7.00
Sodium Nitrate, crude, 95%	Cwt.	5.00— 5.75
Sodium Nitrite	Lb	.12— .15
Sodium Peroxide, f.o.b. New York	Lb.	.30— .35
Sodium Silicate, 42°, car lots	Cwt.	.. — 1.35
Sodium Silicate, 42°, smaller lots	Cwt.	.. — 1.55
Sodium Silicate, 40°, car lots	Cwt.	.. — 1.25
Sodium Silicate, 40°, smaller lots	Cwt.	.. — 1.45
Sodium Sulphate (Glauber's Salts) crystals,		
	Per Cwt. in Bags	1.90— 2.00
	Per Cwt. in Car Lots	1.65— 1.70
Sodium Sulphite	Lb.	.. — .05
Sodium Prussiate, Yellow	Lb	.24— .25
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	4.25— 4.75
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars, f.o.b. Toronto,	Ton	23.75—24.00
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Ton	.. —23.00
Tin Chloride crystals	Lb.	.30— .35
Tri-sodium Phosphate	Lb.	.07½— .08
Ultramarine, Blue	Lb.	.15— .35
White Precipitate (Mercuric-Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	.. —30.00
Whiting (American)	Ton	.. —30.00
Zinc Sulphate, com.	Lb.	.04—.04½
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.08½— .10
Zinc Stearerate	Lb.	.25— .30

Organic.

Acetanilid, C. P.	Lb.	.45— .50
Acetic Acid, glacial, carboys, f.o.b. Shawinigan Falls	Lb.	.. —.20½
Acetic Acid, glacial, carboys, car lots, f.o.b. Shawinigan	Lb.	.. —.16½
Acetic Acid, glacial, bbls., car lots, fo.b. Shawinigan.	Lb.	.. — .16
Acetic Acid, 28%, carload lots	Lb.	.. —.04¼
Acetic Acid, 28%, 25 bbl. lots	Lb.	.. —.04½
Acetic Acid, 28%, 10 bbl. lots	Lb.	.. —.04¾
Acetic Acid, 28%, 5 bbl. lots	Lb.	.. — .05
Acetic Acid, 28%, 1 or 2 bbl. lots	Lb.	.. —.05¼
Acetic Acid, 80%, carload lots	Lb.	.. —.12½
Acetic Acid, 80%, 25 bbl. lots	Lb.	.. —.14½
Acetic Acid, 80%, 15 bbl. lots	Lb.	.. —.15½
Acetic Acid, 80%, 10 bbl. lots	Lb.	.. — .16
Acetic Acid, 80%, 5 bbl. lots	Lb.	.. —.16½
Acetic Acid, 80%, 3 or 4 bbl. lots	Lb.	.. —.17½
Acetic Acid, 80%, 1 or 2 bbl. lots	Lb.	.. —.18
Acetone, pure, drums or over	Lb.	.. — .21
Acetone, pure, lesser amounts	Lb.	.. — .27
Aspirin, in 100-lb. lots	Lb.	.90— 1.00
Alcohol, Absolute Ethyl, case of 1 doz.	1-lb. bottle	.. — 3.15
Alcohol, Absolute Ethyl, in steel drums of 10 gallons capacity	Imp. Gal.	.. —23.00
Alcohol, acetone, bbls. or over	Gal.	.. — 1.00
Alcohol, acetone, lesser amounts	Gal.	.. — 1.30
Alcohol, wood, 95%, bbls. or over	Gal.	.. — 1.15
Alcohol, wood, 95%, half bbl. lots	Gal.	.. — 1.25
Alcohol, wood, 95%, lesser amounts	Gal.	.. — 1.30
Alcohol, wood, 97%. bbls	Gal.	.. — 1.20
Alcohol, wood, 97%, half bbl. lots	Gal.	.. — 1.35
Alcohol, wood, 97%, lesser amounts	Gal.	.. — 1.50
Amyl acetate, technical	Gal.	4.50— 5.00
Amyl Acetate, pure	Lb.	.. — .80
Benzaldehyde	Lb.	1.35— 1.60
Benzoic Acid	Lb.	.85 — .90
Caffeine, English	Lb.	.. — 4.25
Calomel (Mercurous Chloride)	Lb.	.. — 1.25
Camphor, refined, slabs	Lb.	.. — 1.25
Camphor, refined, tal	Lb.	.. — .98
Carbolic Acid, white crystals	Lb.	.20— .22
Chloroform	Lb.	.40— .50
Citric Acid, domestic, crystals	Lb.	.65— .70
Coumarin	Lb.	3.00— 3.50
Cream Tartar, 98%	Lb.	.25— .30
Dextrine, potato	Lb.	.. — .06
Dextrine, corn	Lb.	.. —.08½
Ether, B.P. (conc.)	Lb.	.. — .55
Ether, Sulphuric	Lb.	.28— .38
Formaldehyde, bbls. or over	Lb.	.. —.12¼
Formaldehyde, 200-lb. kegs	Lb	.. —.18¼
Formaldehyde, 100-lb. kegs	Lb.	.. —.19¼
Formaldehyde, 50-lb. kegs	Lb.	.. —.20¼
Formic Acid, 75%	Lb.	.40— .42
Fusel oil, special	Gal.	5.00— 5.25
Fusel oil, refined	Gal.	.. — 6.00
Gallic Acid	Lb.	1.25— 1.75
Glycerine, crude, single tin of 56 lbs.	Lb.	.. — .17
Glycerine, crude, two or more tins	Lb.	.. — .15
Glycerine, C.P., single tin of 56 lbs.	Lb.	.. — .29
Glycerine, C.P., two or more tins	Lb.	.. — .27
Glycerine, (pale straw), single tin 56 lbs.	Lb.	.. — .28
Glycertine, (pale straw), two or more tins	Lb.	.. — .26
Glycerine C.P. drums, 500-1,000 lbs.	Lb.	.. — .21
Glycerine, pale straw, drums, 500-1,000 lbs.	Lb.	.. — .20
Hexamethylenetetramine		.. — .90
Oxalic Acid	Lb.	.18— .20
Oleic Acid	Lb.	.28— .28
Phenacetin	Lb.	2.00— 2.25
Phenolphthalein	Lb.	.. — 2.00

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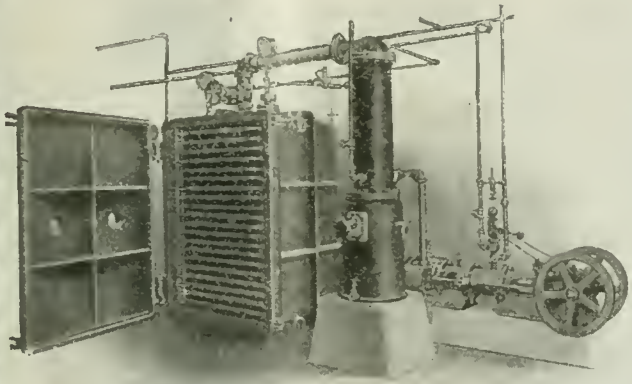
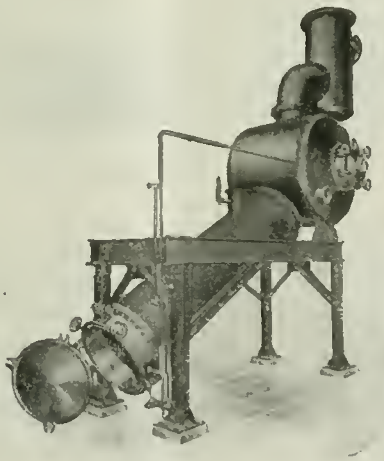


Vacuum Shelf Dryer with dry vacuum pump and condenser



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Vacuum Rotary Dryer—for drying materials that permit agitation.

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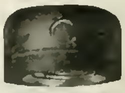

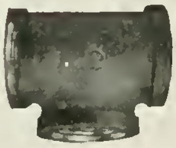

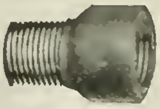

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14

ONTARIO'S MINERALS

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

Hon. H. Mills, Minister

The following table, subject to revision, summarizes the mineral production of Ontario for 1921. As far as possible the figures represent quantities shipped and values received for marketed products. Tons throughout are short tons of 2,000 pounds. Final figures for 1920 are included for comparison.

Summary of Mineral Statistics, 1921

		Quantity		Value	
		1920	1921	1920	1921
Metallic					
Gold	ounces	565,283	709,509	$11,686,043	$14,624,085
Silver	"	11,065,415	8,412,059	10,873,496	5,497,160
Platinum metals	"	19,056	(a) 915	1,996,535	51,060
Copper	lbs.	6,825,772	3,070,719	1,041,994	356,708
Nickel, metallic	"	11,015,692	5,430,147	3,852,141	1,825,359
Nickel, oxide	"	4,890,571	1,402,019	1,151,490	285,391
Cobalt, metallic	"	167,750	32,718	392,926	98,228
Cobalt, oxide	"	569,182	155,554	1,210,810	354,418
Other Nickel and Cobalt compounds	"	161,442	108,814	16,991	114,069
Lead, pig	"	2,232,253	3,570,222	179,714	190,843
Copper in matte exported (b)	tons.	11,715	3,686	2,928,750	737,142
Nickel in matte exported (b)	"	21,371	4,850	10,685,500	1,939,851
Iron ore and briquettes (c)	"	68,616	100	60,958	459
Iron, pig (d)	"	67,164	82,318	2,204,205	2,079,729
Total metallic				$48,281,553	$27,574,202
Non-Metallic					
Actinolite	tons.	100	78	$ 1,160	$ 975
Arsenic, crude and white	lbs.	3,781,389	2,982,525	432,434	233,763
Clay products—					
Brick, common	M.	123,551	99,463	2,209,265	1,743,094
Brick, fancy and pressed	"	32,559	31,481	809,126	673,087
Tile, drain	"	9,784	9,910	359,373	250,040
Tile, roofing and building	tons.	58,737	......	369,530	211,529
Pottery				127,049	67,985
Sewer pipe				860,811	939,464
Cement, Portland	bbls.	2,035,594	2,723,072	4,377,814	6,425,266
Corundum	tons.	196	402	27,000	50,250
Feldspar	"	37,335	15,506	268,295	114,059
Fluorspar	"	3,704	115	67,381	1,744
Graphite, crude and refined	"	1,956	363	132,882	23,273
Gypsum, crushed, ground and calcined	"	74,707	84,765	404,162	433,053
Iron Pyrites	"	148,651	19,375	618,283	91,604
Lime	bush.	4,982,912	2,610,129	1,799,763	1,172,680
Mica	tons.	717	222	51,394	29,630
Mineral water	Imp. gals.	127,150	......	15,059	9,000
Natural gas	M cu. ft.	10,545,000	8,590,000	3,163,500	2,953,000
Peat	tons.	3,900	500	15,600	2,000
Petroleum, crude	bbls.	181,750	172,859	724,145	466,716
Quartz and silica brick	tons.	94,650	12,957	366,441	74,635
Salt	"	206,612	149,599	1,544,867	1,509,287
Sand and gravel	cu. yds.	2,162,241	1,412,956	1,390,704	668,098
Sand-Lime brick	M.	27,703	......	407,766	456,700
Stone, building, trap, granite, etc				3,944,972	1,812,863
Talc, crude and ground	tons.	20,359	9,967	306,319	140,390
Total non-metallic				$24,795,194	$20,554,185
Add metallic				48,281,553	27,574,202
Grand Total				$73,076,747	$48,128,387

(a) Recoveries from Canadian refineries only.

(b) Copper and nickel exports in the form of matte were valued, respectively, at 12½ and 25 cents per pound in 1920, and at 10 and 20 cents in 1921.

(c) Exports and shipments to points other than Ontario blast furnaces.

(d) Proportional product from Ontario ore smelted. Figures cover only the first nine months of 1921.

Dividends and Bonuses paid to the end of 1921 amounted to $23,140,734 for gold mining companies, and $84,388,185 for silver mining companies, or a total of $107,528,919.

The Provincial Assay Office, at No. 5 Queen's Park, Toronto, is maintained by the Department of Mines for the free identification of minerals, free assays under the provisions of the Mining Act of Ontario, and also for general assay work as per the Price List, which may be obtained on application.

For illustrated reports, geological maps, mining laws, and list of publications, apply to

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Muriatic Acid
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are the control back of industry. They not only give you a close and accurate check on all temperature variations, but also the exact temperature on your heat-treating furnaces day and night. Thus, uniform results can be secured day after day without waste of material.

Bristol's Strip Chart Pyrometers are especially desirable where a continuous record of several days' duration is required, and an extra wide open record for very close readings.

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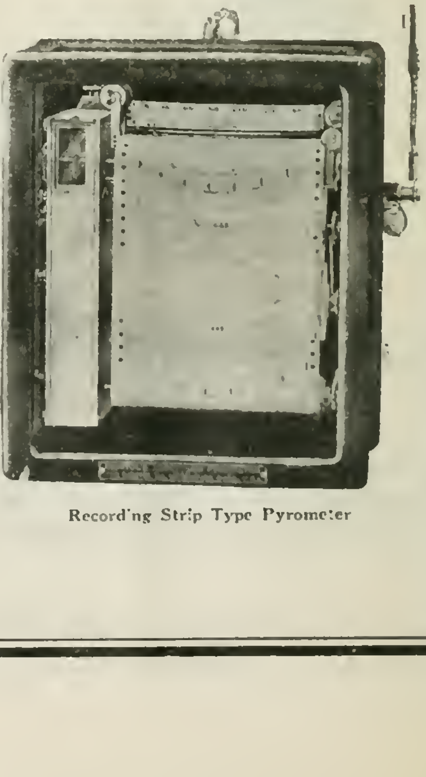

Recording Strip Type Pyrometer

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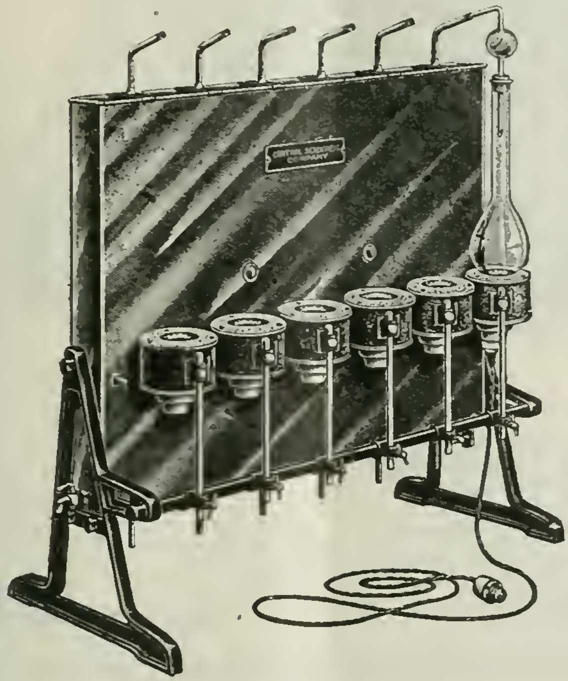
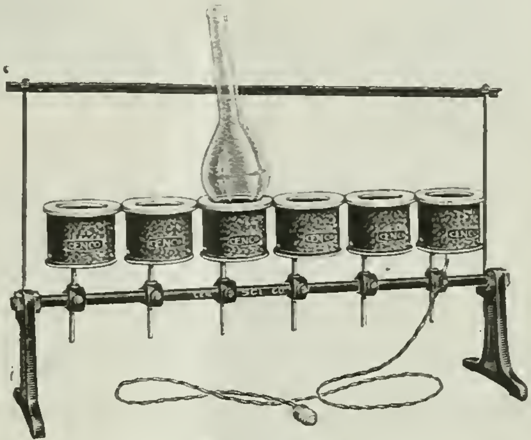


No. 9481-2 Distilling Apparatus
(Table Form)

Note the individually adjustable heaters—an advantage found in very few types of Kjeldahl Apparatus.



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No.	A	B
For volts	110	220
Each	**$103.00**	**$108.00**

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No.	A	B
For volts	110	220
Each	**$105.00**	**$110.00**

9466 KJELDAHL DIGESTION SHELVES, Cenco, Electrically Heated.

No.	A	B	C	D
Number of heaters	6	6	10	10
For volts	110	220	110	220
Each	**$40.00**	**$43.00**	**$65.00**	**$70.00**

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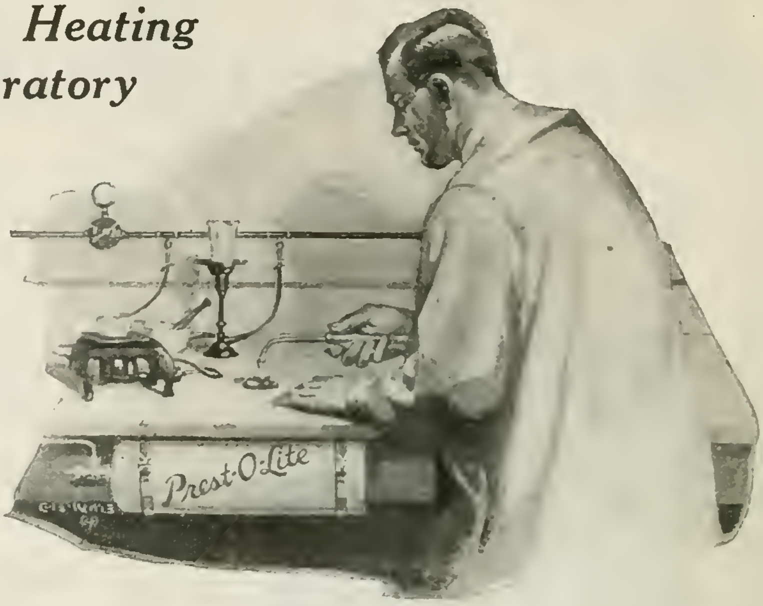

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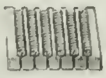
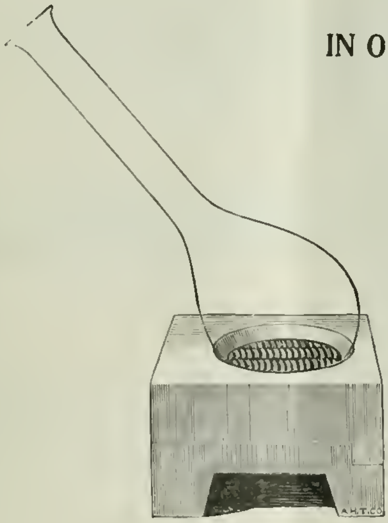


Heating Unit



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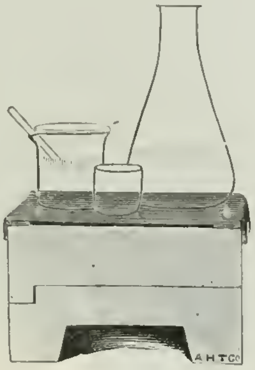

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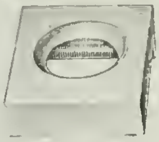
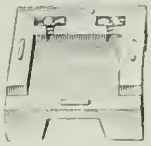


Cover Plate



Base Plate

HEATER, GILMER PATENT ELECTRIC. The cover and base plates are made of asbestos cement, which is not attacked by acid fumes and solutions. These two parts interlock in a way to prevent side slipping, yet they can be taken apart instantly without the removal of a single screw or bolt. The cover plate contains a circular opening 3⅞ inches diameter at the top and 2⅞ inches just over the heating unit. This opening fits exactly an 800-ml Kjeldahl flask. The resistance wire is of nickel chromium alloy highly resistant to acid and alkali. The wire is wound on the plate in such a manner as to place the resulting heat directly under the flask or beaker in the smallest possible area. The heating unit plate is formed of acid and heat resisting porcelain and will average many rewindings before breaking. The assembled stove measures 6 inches long by 5 inches wide by 3½ inches high.

Each heater uses approximately 400 watts. An 800-ml flask containing 450 ml of water will be boiled and 250 ml distilled over inside of 60 minutes. The average life of a heating element under strenuous working conditions is approximately 1,000 working hours, but with care elements have lasted over 3,000 working hours.

This heater was designed primarily for battery installation in the Kjeldahl Ammonia Determination for both digestion and distillation and is furnished with our complete outfits for this purpose. During the digestion period the heat is even and constant, requiring no watching for frothing or shaking of flask to remove particles or samples from the sides as with gas. The high temperature attained after 15 minutes from start gives an even, brisk boil to the acid, with subsequent rapid oxidation. The time on each batch of determinations and for each flask of the batch is always the same, allowing systematic arrangement of work, an impossibility where gas flames have to be constantly adjusted. The distillation is even and has less "spurting." With both periods of the work the heat is controlled with one snap of the switch. With the Gilmer heater, flasks are only rinsed before re-use.

While the heater is designed for Kjeldahl determinations, its use is by no means limited to such work. With its circular opening and flat top, 5 x 6 inches, the heater readily adapts itself to wide uses. The heat can be varied by the location of the vessel, from 800° C for incineration to the slow simmering heat of a hot plate. The circular opening and flat surface will take all the common laboratory vessels, Kjeldahl flasks, evaporating dishes up to 2,500-ml capacity, crucible, boiling flasks and beakers. With the addition of the metal top, the heater makes an excellent hot plate suitable for potash determinations (evaporation, digestion and incineration), incineration of coals, water analysis, phosphoric acid determination (digestion of samples and incineration of insolubles), ash determinations and many other common laboratory analyses.

6130. **Heater, Gilmer Patent Electric,** as above described, without metal top. For volts	55	110
Each, complete	5.00	5.00
Code Word	*Igibv*	*Igiep*
6131. **Heater, Gilmer Patent Electric,** with metal top for use as hot plate	6.00	6.00
Code Word	*Igitk*	*Igix*

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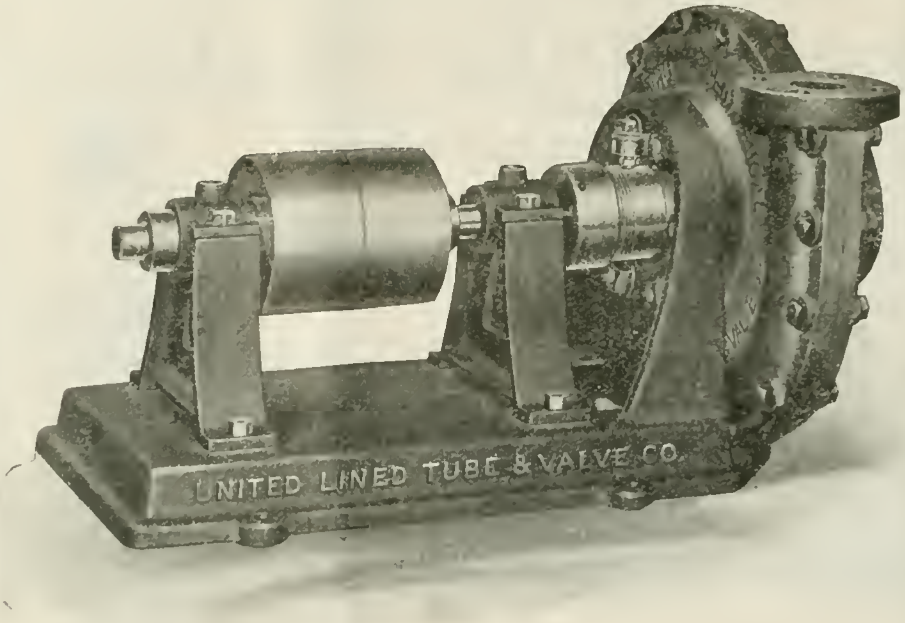

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TO END OF DECEMBER, 1921

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Aggregate Value of $734,259,619

Production for Year Ending December, 1921, $28,066,641

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Angus Richardson, A.M.E.I.C., was Resident to Mr. Dobbin on the work, and J. Fentie, Superintendent for the W. H. Yates Construction Company.

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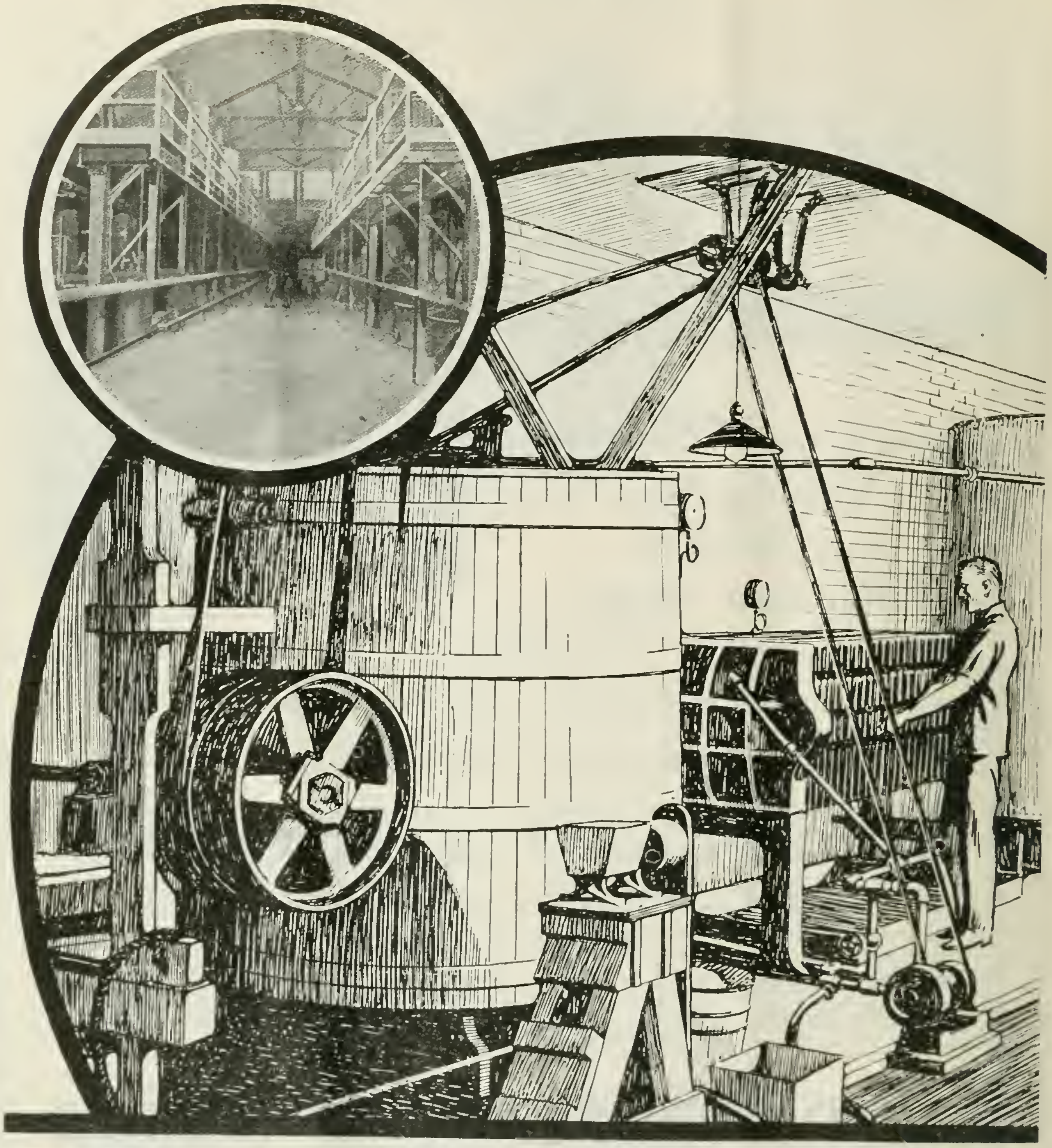

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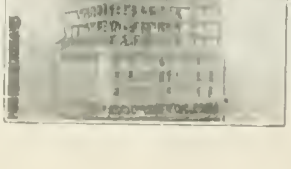

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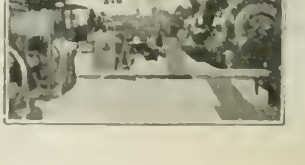

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Size No.	3 0	2 0	0	1	2	3	4	5
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Lids, each	.04	.04	.04	.04	.05	.09	.12	.15

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Diam. at top, MM	32	37	41	56	67	81	96
Price, each	.12	.15	.18	.37	.50	.53	.75
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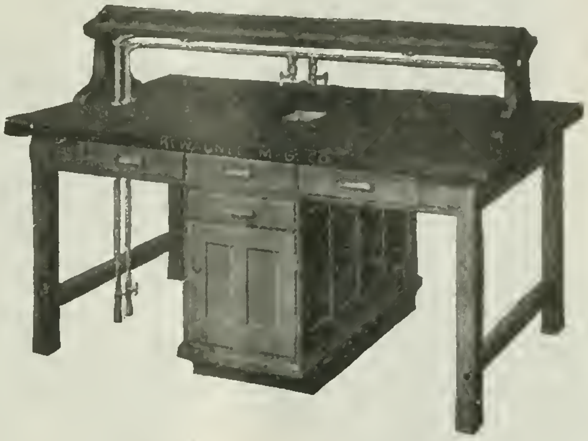

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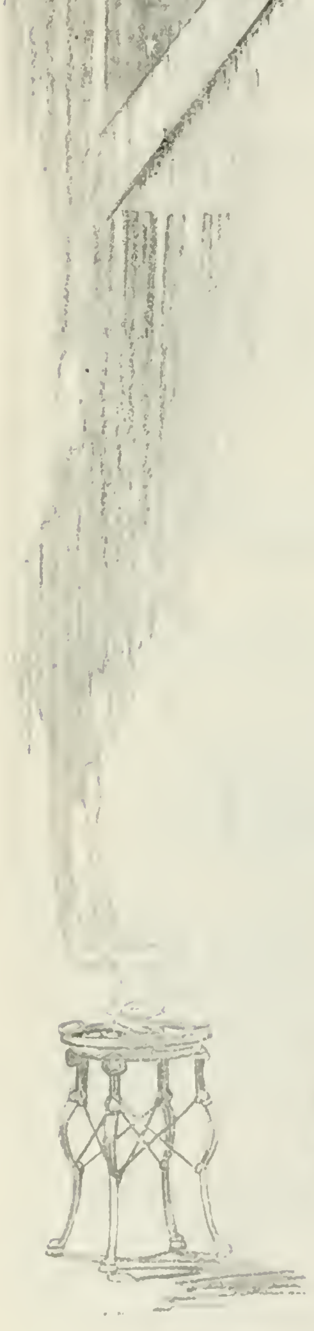

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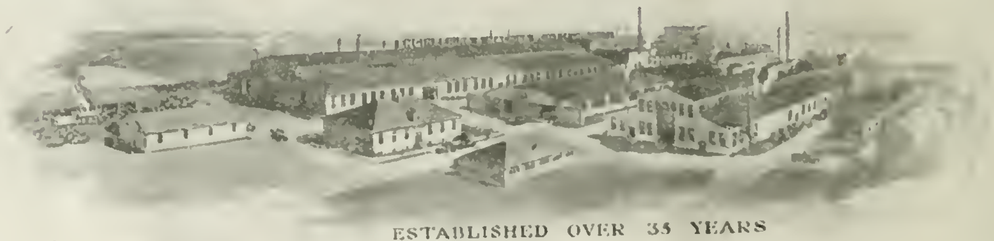

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TABLE OF CONTENTS

Page

EDITORIALS
- "Chemicals and Allied Products" 257
- Northern Ontario 257
- Big End vs. Small End 258

LETTER OF GREETING FROM PRESIDENT ARMSTRONG, SOCIETY OF CHEMICAL INDUSTRY 259
AMMONIA AS A REFRIGERANT—I. By W. H. Motz 260
EXPANSION AT UNIVERSITY OF BRITISH COLUMBIA 264
FIRST CANADIAN LIQUID CHLORINE PLANT..... 264
THE DEVELOPMENT OF INDUSTRIAL ELECTRIC HEATING FOR LOW TEMPERATURE ENAMELING By W. S. Scott 265
CHEMICAL SOCIETY NEWS 268
REPORT OF ORGANIZATION MEETING OF WESTERN ONTARIO SECTION, CANADIAN INSTITUTE OF CHEMISTRY 268
DR. A. McGILL (Sketch) 269

Page

DR. RUTTAN ADDRESSES MONTREAL SECTION, S.C.I. 269
FUEL PROBLEM DISCUSSED BY OTTAWA SECTION, S.C.I. 270
TORONTO SECTION, S.C.I. ADDRESSED BY RALPH McKEE 271
POSITIONS OPEN IN CIVIL SERVICE 272
S.P.S. REUNION 272
"CHEMICALS AND ALLIED PRODUCTS, 1919-20" (Reviewed) 273
MINING AND METALLURGY IN BRITISH COLUMBIA 274
WORLD CONDITIONS AND NEWS IN CHEMICAL FIELDS 275
NITRATE COMMITTEE APPOINTS CANADIAN REPRESENTATIVE 275
INDUSTRIAL DEVELOPMENTS 276
NORTHERN ONTARIO MINING NOTES 276
BRITISH COLUMBIA INDUSTRIAL NEWS 276
MARKET PRICES 277
INDEX TO VOL. VI 279
BUYERS' GUIDE 43
INDEX TO ADVERTISERS 52

FROM THE PUBLISHERS—

DEVELOPING THE WEAK SIDE

There is a general tendency, almost a natural law, whereby we go ahead developing our strong points and attempt to cover up those underdeveloped portions of our character or ability.

Those who make a study of such matters from a scientific viewpoint are continually pointing out that great success can only be attained by seeking out these weak spots and stimulating their development. Naturally, if success is measured by the area enclosed by lines representing heights of development, there will not be much area enclosed by a single straight line or a three-sided development. In short, the success probable from a building up of the short lines is more apt than otherwise, to be proportioned to the square of the development.

With all due apologies to those unknown persons who first pointed out this analogy, we think that it applies somewhat to the chemical profession and chemistry and science in industry. Our thoughtful readers are asked to think it over and adjust themselves accordingly.

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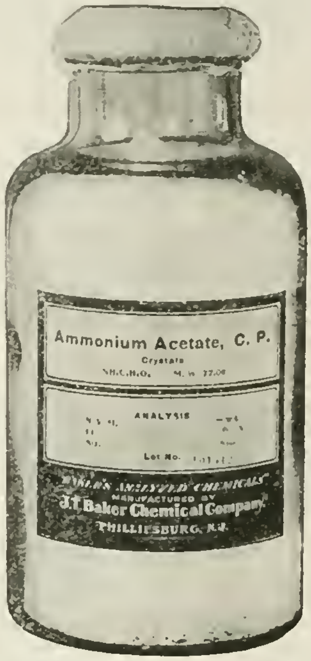

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EDITORIALS

"CHEMICALS AND ALLIED PRODUCTS"

THIS is the name of a little booklet, constituting a report on Canadian industries in this field for the years 1919-21, based on reports gathered through the Bureau of Statistics, Ottawa. We were not always so well supplied with this type of information as we have been for the last two or three years; and it is some indication of progress to have the Dominion Government supply such data. We would like to know that such reports were being received by those who see only some of our larger and more outstanding industries, such as Agriculture. While Agriculture is basic, Canada has a range and number of specialized chemical industries possibly in advance of any other country with the same population.

This report demonstrates that war activities have left business in these lines more advanced than would otherwise have been the case. Had we followed our normal curve in 1914, we would not be where we are in 1922, taking into consideration the great rise and fall in production. Among the outstanding groups of industries which have shown progress, the paint trade needs special mention. This is an exceedingly well-organized group of manufacturers engaged in carrying on national advertising campaigns to increase sales; and the results show in the amounts of basic chemicals they are consuming. The industrial gas business, or the compressed gas industry has made rapid progress The number of plants has increased from fourteen in 1918, to twenty-five in 1920. They produced gases in 1920, very close to the two million dollar mark.

Perhaps the best indication of progress, over a period where price changes make total values a poor measure of production, is the number of plants in operation, and the total number of people employed. The total number of employees in Canada in all chemical and allied industries, in 1918, was 15,603, and their total salaries and wages amounted to $16,384,419. In 1920, the number employed was 17,283 and their receipts in wages $21,736,162. The distribution of these industries, measured on the same basis, would indicate that about 55% were located in Ontario and 30% in Quebec, with 10% in British Columbia

1921 shows a great decrease in the number of employees, wages and selling value of products, as compared with 1920, but is not much below 1919. Comparing 1921 with 1920, the wages paid dropped around 33% in total, and the value of the products made, dropped some 38%. The number of plants increased over 1919, from 429 to 444. It is rather interesting to note that Canadians own less than one sixth of the capital stock and bonds, and less than one-third is British owned.

The general significance of the situation would seem to be that Canada is prepared to make a tremendous struggle for independence, and the development of specialized industries. No doubt, the measure of protection granted assists the situation in most instances; but there are a few cases where genuine chemical industries are being carried on without protection. It is a credit to our chemical manufacturers that they are able to cover the field so well with such a relatively small and scattered market, and against the keenest kind of European and American competition. The hope of the situation, from the viewpoint of the manufacturer, is expressed in the figures of import and export. We actually imported chemical and allied products from the United States, in 1921, amounting to a value of $26,766,364, and from the United Kingdom $6,048,717, against total import of $36,334,612. Our total exports, however, ran up to $19,582,051, for the same year. 1922 will probably show a relative increase in imports over exports, but a net decrease on both sides, when compared with 1921.

The outlook for chemical manufacturing is very fair in many lines, and is good in all those where operations may be carried on in a small way; so that there need be no overproduction in order to supply Canadian requirements. As to the future, everything depends on three factors: (1) How rapidly we increase our consumer population; (2) How kind our immediate neighbors and the world in general may be in tariff matters; (3) and the amount of skill and research ability we show in the development of science in industry and our own resources.

NORTHERN ONTARIO

FEW Canadians have any well-defined ideas of the great area whose gateway is the Temiskaming and Northern Ontario Railway station at North Bay.

There are many who know of the Temagami district as a hunter's paradise and of Cobalt, the silver city. A great many do not know anything beyond, other than the existence of a town named Haileybury, wiped out by the fire on October 4th last.

How many know that one hundred and fifty miles by rail, beyond Haileybury, through a land of excellent wheat and grazing conditions, there are within forty miles of each other two towns, one containing the greatest gold mine in the world, and the other the greatest single paper mill in the world.

From the paper mill daily goes a train of newspaper carrying $33,000 worth of newsprint paper. The gold fields of Porcupine and Kirkland Lake will probably reach a total output of $20,000,000 for the year, representing an increase of about $5,000,000 over last year.

The agricultural land extends practically to James Bay. Rivers running into James Bay have over a score of water powers from 5,000 horsepower up, of which only six are harnessed. One of these is to be used to run the Temiskaming and Northern Ontario Railway trains by electricity.

Most of this country lies south of the latitude of Winnipeg and all of it lies south of Edmonton. A circle with a radius of fifty miles centred at a point near Matheson would contain fifteen towns and villages, having a combined population of nearly 25,000, including four towns of 3,000 or more.

This great area and its further development to James Bay should be watched by all Canadians. Its uniform soil condition, presenting a good opportunity for scientific agriculture; its water powers, with their industrial potentialities; its operating mines and valuable prospect areas, including large gypsum deposits and the possibility of opening up the enormous iron ore deposits of the Belcher Islands in Hudson's Bay, and its growing industrial activity will no doubt make notable contribution to the chemical industry of Canada in time. We do not write this now, so much for that reason, but because it behooves us every now and then to take a glimpse at our great assets.

CONFIDENCE: THE BASIS OF BUSINESS

LITVINOFF, disappointed in his efforts to exchange "concessions" for collateral, cynically remarked "Instead of credits we get sermons on confidence, and unfortunately in Europe to-day, confidence is not marketable." It would be hard to find a statement more patently empty of logic. Confidence and credit are cognately synonymous and are just the two things Russia lacks; granted these, her resources are practically unlimited, but Russia under the Soviets has snapped her fingers at all the rubric of international credit and hopes to substitute bluff for confidence. It can't be done, and the fact that Russia has not been allowed to do it and that Germany is not being allowed to do it, and that the honors list must be investigated and Horatio Bottomley serve his time, all point to the general soundness of civilization.

BIG END VS. SMALL END

GULLIVER, in the course of his stay in Lilliput became involved in a controversy as to whether the small end of an egg was as important as the big end.

Something similar is going on under the surface in the industrial life of to-day, that is, the controversy as to who is the important man in industry, of the two classes which, for want of better terms we classify as practical and technical.

Much argument can be adduced to support the claim of the practical man, that being the actual producer, he is the king pin of industry, or to bolster up the view of the technical man, that his knowledge of basic principles makes him the most valuable.

In a small group where this matter was being discussed in a mill, the practical man countered sharply by pointing out that when expenses had to be curtailed, the well-paid technical man was let go, while the practical man was retained.

Both parties to the controversy are acting as the Lilliputians did about the egg, forgetting that the important thing is the egg. The small or big ends are mere physical details. Big end would be of little use to the egg without small end. Neither the practical man, nor the technical man is self-contained. Each, depending on his own qualification, is like a man going into a fight with one hand tied behind him.

Anyone who has watched the growth of industry in Canada will have noted the reducing lengths of time in which equal progress is being made. Roughly it might be said that about the same progress in the application of science to industry took place in the twenty years 1885 to 1905, as in the ten years 1905 to 1915 or the five years 1915 to 1920, at least that appears evident in four large industrial groups with which the writer has had some acquaintance,—mining, paving and construction, pulp and paper, and the packing house industry. To a large extent it appears to be due to the infiltration of the trained man, who has added in due course an experimental, practical knowledge to his equipment and who thus attacks the problems of practice with a mind free from shackling shibboleths.

The development of the Society of Chemical Industry in Canada and the organization of the Canadian Institute of Chemistry, the expansion of the Engineering Institute of Canada and other Scientific bodies—these are just evidences of a spherical tendency in the great industrial egg. The small end is rounding out.

None the less, must we steer clear of over emphasizing the scientific detail, which should always be subservient to practical economy? The plant chemist with a due sense of proportion will get an approximation in twenty minutes that may be used for guidance, while the academic chemist, whose results, true to three decimal places are received twenty-four hours late, is of little use.

What we need in industry is balance, co-operation and common sense. The old practical man is a mine of valuable knowledge, hard won in sweat and dolor. Yielding his sword as he must to the brevetted stripling, it becomes the new incumbent to take a chivalrous joy in exchanging ideas. Incidentally the man who delights in the practical as distinct from the theoretical, forms theories that would put Einstein in a blue funk.

After all, the egg's the thing.

PEACE AND GOODWILL

THERE is a tendency to feel a little cynical in using the terms "Peace" and "Goodwill." There is a technical state of peace, and there is often sold a technical goodwill. Such would seem to be the chaff with which we might try to solace our souls. There is still one great hope, and it is this, that some day the world will see that progress cannot be made without the application of common sense to the International and Industrial situations.

The supreme expression of common sense is the practice of Christianity, and as Mr. Wells puts it, that has not yet been tried. If it had ever been honestly tried, with the present results, we might have cause for misery. That it has not yet been tried is a source of hope.

LETTER OF GREETING FROM PRESIDENT E. F. ARMSTRONG, S.C.I.

We are publishing below a letter from Dr. E. F. Armstrong, President of the Society of Chemical Industry. It is written particularly for the Sections in Canada, and as the activities of this Society are exceedingly well known to all Canadian Chemists, we know his message will be of interest. The Society numbers amongst its membership here, practically all of those who have rendered a leading service in the development of chemical education, research and industry throughout the Dominion during the past twenty years.

The letter was received by Dr. R. F. Ruttan, chairman of Executive, Canadian Sections.

SOCIETY OF CHEMICAL INDUSTRY

Central House,
46 and 47 Finsbury Square,
London, E.C.2,
10th December, 1922

The Chairman and Executive,
Canadian Sections,
Society of Chemical Industry.

Gentlemen:

I conceive it to be one of the main duties of the President during his period of office to visit as many as possible of the Sections of the Society, both for the purpose of interchanging ideas and realizing local conditions, and of ventilating more or less publicly some of the aims, difficulties, and achievements of the chemist. Unfortunately, distance, both in space and time, will prevent me from visiting the very active Sections in Canada, and I am therefore constrained to send this letter as a message of goodwill, testifying to the great interest which the Council at home has in the progress of Chemistry in the Dominion

The real aim of the Society is the encouragement of the progress of chemistry in Industry, and, believing as we must, that chemical science is the foundation of all industry, of every manufacturing process and of every day life, we feel sure that the trained chemist must play an ever increasing part in the development of the natural resources, and indeed of civilization itself, in your country.

Untrammelled to a large extent by the traditions, restrictions, and mistakes of the past which play so large a part in the daily life in the old country, you have a unique opportunity to win for the chemist an all prominent position and influence in the development of the Canadian nation. To achieve this, the chemist must so shape his activities as to be regarded above all as a shrewd counsellor and a constructive adventurer, in addition to his more generally understood role as an analyst and guardian of the public services.

Important as is the dual position of Chemistry as the detective and policeman among the Sciences, it is far more necessary that to-day, in what is perforce a utilitarian world, it should establish its real position as the constructive Science, affording the foundation of theory and experiment on which engineering and physical science can achieve their conquests of nature.

If these objects are to be attained, the chemist must be a man of broad and practical outlook, enthused with the noblest ideals and with a wide knowledge of his subject. We must aim at the highest standard of professional etiquette within our ranks and avoid the prostitution of our status by the unqualified; above all, we must realize to the full, the advantages of co-operation, believing that it is only by a united effort that the profession of chemistry can attain to the goal of its desires.

If the ideals indicated in the foregoing are high, they are all the more worthy of achievement, and we feel that our Society has done and can continue to do the pioneer work towards their attainment.

The temptation to form a purely Canadian organization must be often before you, but you will allow us to urge that, the willing help without the interference, and the mature experience of the larger body at home is far too great a weapon in your armory to be lightly abandoned.

During the last eighteen months, the Society has had the advantage both of paying an official visit to Canada and of having as its President, Dr. Ruttan, an eminent Canadian, who adds great personal charm to his shrewd character as a man of affairs. We feel in consequence that we know you more intimately than at any previous time, and that the link between us to-day is based on personal attachment as well as on loyalty to the Motherland. To-day when it falls to the lot of the Anglo-Saxon nations to bring order out of the world's chaos and start civilization once more in the path of peace, the opportunity for the individual chemist and for our Society is a great one, and we must prove ourselves worthy of it.

I desire to assure you that the Council takes a very real and deep interest in the welfare of the Society in Canada, and that it appreciates very highly the efforts that you and our members in the Dominion have made to consolidate the work of the Sections and to develop their potentialities.

I need hardly say that we shall, at all times, be glad to render you such support as we can in your valuable endeavors.

With very kind regards,
Yours sincerely
(Signed) E. F. Armstrong, President

Ammonia as a Refrigerant*---I

A Study of Fundamental Data Relative to All Factors in the Operation of Compression Refrigerating Systems

By W. H. Motz

IN mechanical refrigerating systems using liquefiable fluid, the working substance is placed in such a condition that it will absorb heat from a material at a temperature below that of the atmosphere. After this absorption of heat, the working fluid is placed in such a state that it will give up the absorbed heat and the heat added during the process, to a material at a temperature higher than that of the refrigerator. This is the general principle underlying the operation of the refrigerating systems using a liquefiable fluid, and for the present, attention will be directed to the compression refrigerating system which consists of an evaporator, compressor, condenser, and an expansion or throttle valve, primarily.

The exact amount of heat absorbed by each pound of the refrigerant will depend upon the individual refrigerant and the working conditions. In general, it will be observed that the theory underlying the operation of the compression system is independent of the refrigerant, and will hold true for any system using a liquefiable fluid. However, since ammonia is used most extensively in the United States and Canada, the various refrigerating effects, heat quantities, etc., will be calculated for ammonia.

The principal physical properties of saturated ammonia are shown by the following abridged Bureau of Standards Table of the Properties of Ammonia. The properties shown by this table are the five cardinal properties of matter,—namely, temperature, pressure, volume, heat content, and entropy.

ABRIDGED BUREAU OF STANDARDS TABLES OF PROPERTIES OF AMMONIA
Saturated Ammonia—Temperature Table

Temp. Fahr.	Pressure Lbs. per Sq. Inch	Special Volume Cubic Feet Per Lb.		Total Heat of Liquid	Latent Heat of Evaporation	Total Heat of Vapor	Entropy		
		Liquid	Vapor				Liquid	Evaporation	Vapor
—40°	10.41	.02322	24.84	0.0	597.0	597.0	.000	1.423	1.423
—30°	13.91	.02345	18.96	10.7	590.2	600.9	.025	1.374	1.399
—20°	18.30	.02369	14.67	21.4	583.3	604.7	.050	1.327	1.377
—10°	23.75	.02393	11.50	32.1	576.1	608.2	.074	1.281	1.355
0°	30.42	.02419	9.114	42.9	568.7	611.6	.097	1.237	1.334
5°	34.28	.02432	8.149	48.3	564.9	613.2	.109	1.216	1.325
10°	38.51	.02446	7.304	53.8	561.0	614.8	.121	1.195	1.316
20°	48.21	.02474	5.910	64.7	553.1	617.8	.144	1.153	1.297
30°	59.74	.02503	4.827	75.7	544.9	620.6	.166	1.113	1.279
40°	73.32	.02533	3.974	86.8	536.5	623.3	.189	1.074	1.263
50°	89.19	.02564	3.296	97.9	527.7	625.6	.211	1.036	1.247
60°	107.6	.02597	2.754	109.2	518.5	627.7	.232	0.998	1.230
70°	128.8	.02632	2.314	120.5	508.9	629.4	.254	.961	1.215
80°	153.1	.02668	1.956	132.0	499.1	631.1	.275	.925	1.200
86°	169.2	.02691	1.774	138.9	493.0	631.9	.287	.904	1.191
90°	180.7	.02707	1.663	143.5	488.8	632.3	.296	.889	1.185
100°	211.9	.02747	1.419	155.2	478.0	633.2	.316	.854	1.170
110°	247.0	.02790	1.217	167.0	466.7	633.7	.337	.819	1.156
120°	286.1	.02836	1.018	179.0	451.9	633.9	.358	.785	1.143

The first column gives the saturated temperatures corresponding to the pressure exerted upon the liquid. This is the temperature of the ammonia vapor when it is in the presence of some of the liquid and at the given pressures. Similarly, the pressure of the saturated vapor and liquid are shown by the second column, in lbs. per sq. in. absolute. The corresponding gauge pressure may be obtained by subtracting the pressure of the atmosphere. The third and fourth columns indicate the specific volumes of the liquid and vapor respectively, in cu. ft. per lb. Column five gives the sensible heat of the liquid above a reference temperature of —40° F., in B.T.U. per lb. Column six indicates the latent heat of evaporation in B.T.U. per lb.

The latent heat of evaporation depends upon two factors. The internal latent heat of evaporation is the heat required to transform the molecules of the liquid into the condition of the molecules of the vapor. This is sometimes termed the heat of disintegration. The external latent heat of evaporation is the heat required to expand the substance from the small volume of the liquid to the large volume of the vapor against the pressure during the process.

Column seven gives the heat content of the saturated vapor in B.T.U. per lb. This is the sum of the sensible heat of the liquid and the latent heat of evaporation. The last three columns indicate the entropy of the liquid, evaporation, and the vapor. Entropy is the ratio obtained by the amount of heat necessary to bring the substance to a given state by the true average absolute temperature during the process. An inspection of the table discloses the fact that ammonia has medium pressures and temperatures; the specific volume of the vapor is not excessive, and the latent heat of evaporation is fairly large. The chemical properties of ammonia are such that make it readily adaptable in practical commercial refrigerating systems.

The heat absorbed in refrigerating processes is usually measured in British thermal units, B.T.U. The commercial unit of refrigeration, that is, a ton of refrigeration, is the quantity of heat required to melt one ton of pure solid ice into water, from and at 32° F. This is equal to 144 × 2000 = 288,000 B.T.U., since the latent heat of fusion of ice is approximately 144 B.T.U. per lb. The removal of heat at the rate of 288,000 B.T.U. per day of twenty-four hours may be termed one ton of refrigerating-power.

But, in order to make the unit of capacity more definite, the saturated temperature of the refrigerant in the evaporator and condenser must be taken into consideration. The saturated temperatures of 5° in the evaporator, and 86° in the condenser have been adopted for this purpose.

The specifications of the standard of rating of refrigerating systems using liquefiable fluids may be tabulated, therefore, as follows:

One ton of refrigerating power = 288,000 B.T.U. per 24 hours
One ton of refrigerating power = 12,000 B.T.U. per hour
One ton of refrigerating power = 200 B.T.U. per minute
One ton of refrigerating power = 3 33 B.T.U. per second
Standard saturated evaporator temperature = 5° F.
Corresponding ammonia pressure = 34.28 lbs. per sq. in. abs.
Standard saturated condenser temperature = 86° F.
Corresponding ammonia pressure = 169.2 lbs. per sq. in. abs.

Absorption of Heat by Ammonia

In order to place the ammonia in such a condition that it will absorb heat from the material at low temperature, a certani pressure must be maintained. The pressure must be maintained so that the boiling temperature of the ammonia is a few degrees below the material of low temperature. The heat then flows by natural tendency into the boiling ammonia, causing it to be evaporated. The pressure is reduced from that existing in the condenser to the pressure existing in the evaporator by means of a throttle valve, which is commonly termed the expansion valve.

---

*Paper delivered before Convention of Practical Refrigerating Engineers, November 2-4, St. Louis, Mo., by W. H. Motz, Technical Editor, "Ice and Refrigeration" (Chicago).

The function of the expansion valve is, therefore, to throttle the pressure of the refrigerant from the high pressure in the condenser to the low pressure in the evaporating coils. The liquid ammonia is simply allowed to pass through a small orifice in the expansion valve. This throttling process takes place practically without the addition or extraction of heat. From this, it will be noted that the heat content of the ammonia remains constant in passing through the expansion valve (providing the velocity of the ammonia is the same before and after passing the valve).

Refrigerating Effect

It is evident that, unless the ammonia can be supplied to the evaporator at the temperature existing in the evaporator, some of the ammonia must be evaporated to cool the remaining amount of liquid ammonia to the temperature of the evaporator. The refrigerating effect, due to the latent heat of evaporation, will be reduced by the amount necessary to cool the liquid. The relation between the refrigerating effect, the latent heat of vaporization, and the heat to cool the liquid, may be stated symbolically as follows:

$$R = l - (h_1 - h_2)$$

where R = refrigerating effect in B.T.U. per lb. of ammonia

l = latent heat of vaporization in B.T.U. per lb. ammonia

h_1 = total heat of the liquid at the temperature just before the expansion valve

h_2 = heat content of the liquid at temperature existing in the evaporator.

As an example, it may be assumed that the temperature of the liquid ammonia just before the expansion valve is 86°, and that the temperature of the evaporating ammonia must be maintained at 5°. It is further assumed that the ammonia leaves the evaporator coils in a dry saturated state, that is, all vapor and at 5° F. For this condition, the heat required to cool the liquid ammonia from 86° to 5° would be found as follows:

$$h_1 - h_2 = 138.9 - 48.3 = 90.6 \text{ B.T.U. per lb.}$$

Advantage of Aftercooling the Liquid

In the foregoing, the temperature of 86° may be the saturation temperature due to the pressure existing in the condenser. If, by means of the use of cold water, it is possible to cool the liquid ammonia to 66°, the heat required to further cool the liquid ammonia to 5°, is found as follows:

$$h_1 - h_2 = 116.0 - 48.3 = 67.7$$

It is evident that the refrigerating effect due to the latent heat of vaporization will be reduced by the foregoing amounts of heat required to cool the liquid ammonia. At the saturated temperature of 5° F., the latent heat of evaporation is 564.9 B.T.U. per lb.; thus, the available refrigerating effects may, therefore, be calculated as follows:

$$R_{86} = 564.9 - 90.6 = 474.3 \text{ B.T.U. per lb.}$$

$$R_{66} = 564.9 - 67.7 = 497.2 \text{ B.T.U. per lb.}$$

The relative magnitudes of the refrigerating effects, 474.3 and 497.2, in B.T.U. per pound of ammonia, indicate the desirability of cooling the liquid ammonia to as low a temperature as possible before it is introduced into the evaporating coils. The gain is shown as follows:

$$\frac{497.2 - 474.3}{474.3} = 0.0483 = 4.83\%$$

This cooling should be accomplished by the use of cold water, or other means, and not by means of the return vapor from the refrigerating coils. In the foregoing, it is noted that the available amount of heat for refrigeration depends upon the latent heat of vaporization and the sensible heat of the liquid.

Heat Contents of Ammonia

It will be remembered that the action through the expansion or throttle valve is one of constant heat content: that is, the heat content of the liquid before the expansion valve is the same as the heat content of the mixture after the valve. Therefore, it is evident that the refrigerating effect must be equal to the heat content of the vapor leaving the evaporator coils, minus the heat content of the liquid ammonia, just before the expansion valve. This may be expressed symbolically as follows:

$$R = H - h_1$$

where H = heat content of vapor leaving refrigerator coils

The refrigerating effect for ammonia under the conditions in the foregoing example would be found as follows:

$$R_{86} = 613.2 - 138.9 = 474.3$$

$$R_{66} = 613.2 - 116.0 = 497.2$$

Table 1 shows the refrigerating effects for ammonia under different condenser and evaporator temperatures. The temperatures existing in the condenser and the evaporator are the saturated temperatures due to the existing pressures. In calculating Table 1, it was assumed that the liquid reaches the expansion valve at the saturated temperature, due to the pressure in the condenser, and that the ammonia vapor leaves the evaporator at the temperature corresponding to the pressure therein; in other words, in a dry and saturated state. From Table I, it will be noted that the refrigerating effects vary from 514.1 to 430.0 B.T.U. per pound for the assumed condition.

It is sometimes interesting to note the relation between the pounds of refrigeration obtained from a pound of ammonia. This is expressed as follows:

Lbs. refr. per lb. ammonia = R − 144.

If the saturated temperatures in the evaporator and condenser are 5° and 86° respectively, from Table 1 it will be noted that the refrigerating effect is 474.3. The pounds of refrigeration per pound of ammonia would be equal to 474.3 ÷ 144 = 3.29.

Effect of Superheating of Vapor

If the vapors returning from the evaporator become superheated several degrees above the temperature of the boiling

TABLE 1.—REFRIGERATING EFFECT OF AMMONIA, B.T.U. PER LB.

Saturated Temperature of Liquid in Condenser

Sat. Temp. of Vapor in Evaporator	60° F.	65° F.	70° F.	75° F.	80° F.	85° F.	86° F.	90° F.	95° F.	100° F.	105° F.	110° F.
—40° F.	487.8	482.2	476.5	470.8	465.0	459.3	458.1	453.5	447.7	441.8	435.9	430.0
—35° F.	489.7	484.1	478.4	472.7	466.9	461.2	460.0	455.4	449.6	443.7	437.8	431.9
—30° F.	491.7	486.1	480.4	474.7	468.9	463.2	462.0	457.4	451.6	445.7	439.8	433.9
—25° F.	493.6	488.0	482.3	476.6	470.8	465.1	463.9	459.3	453.5	447.6	441.7	435.8
—20° F.	495.5	489.9	484.2	478.5	472.7	467.0	465.8	461.2	455.4	449.5	443.6	437.7
—15° F.	497.2	491.6	485.9	480.2	474.4	468.7	467.5	462.9	457.1	451.2	445.3	439.4
—10° F.	499.0	493.4	487.7	482.0	476.2	470.5	469.3	464.7	458.9	453.0	447.1	441.2
— 5° F.	500.7	495.1	489.4	483.7	477.9	472.2	471.0	466.4	460.6	454.7	448.8	442.9
0° F.	502.4	496.8	491.1	485.4	479.6	473.9	472.7	468.1	462.3	456.4	450.0	444.6
5° F.	504.0	498.4	492.7	487.0	481.2	475.5	474.3	469.7	463.9	458.0	451.6	446.2
10° F.	505.6	500.0	494.3	488.6	482.8	477.1	475.9	471.3	465.5	459.6	453.2	447.8
15° F.	507.1	501.5	495.8	490.1	484.3	478.6	477.4	472.8	467.0	461.1	454.7	449.3
20° F.	508.6	503.0	497.3	491.6	485.8	480.1	478.9	474.3	468.5	462.6	456.2	450.8
25° F.	510.1	504.5	498.8	493.1	487.3	481.6	480.4	475.8	470.0	464.1	457.7	452.3
30° F.	511.4	505.8	500.1	494.4	488.6	482.9	481.7	477.1	471.3	465.4	459.0	453.6
35° F.	512.7	507.1	501.4	495.7	489.9	484.2	483.0	478.4	472.6	466.6	460.3	454.9
40° F.	514.1	508.5	502.8	497.1	491.3	485.6	484.4	479.8	474.0	468.1	461.7	456.3

ammonia in the evaporator, it is evident that a given weight will contain more heat than if the vapor was at the saturation temperature. The heat which superheats the vapor may be absorbed either in the evaporator or along the suction line. The difference between the heat content of the superheated vapor and the saturated liquid will give the heat absorbed, or the refrigerating effect. It may be assumed that the vapor is superheated from 5° to 40°, the saturated temperature being 5°, and that the saturated Condenser temperature is 86°. The heat content of the vapor at a pressure corresponding to 5° F. and at a temperature of 40° would be 634 B.T.U. per lb., according to the Bureau of Standards heat content-pressure diagram for ammonia. The corresponding refrigerating effect would be:

$$634 - 138.9 = 495.1 \text{ B.T.U.}$$

From the foregoing, the refrigerating effect at 5° and 86° was seen to be 474 3 B.T.U. The increase in the refrigerating effect would be as follows:

$$\frac{495\ 1 - 474.3}{474.3} = 0.0438 = 4\ 38\%$$

Although the superheating of the vapor increases the refrigerating effect per unit weight of ammonia, the volume of the unit weight will also be increased. Being at a temperature several degrees above that of the evaporator it is less dense, and therefore weighs less per unit volume, since the change of density of a vapor or gas is approximately proportional to the change of absolute temperature. Under the conditions of the foregoing problems, the volume of one pound of the saturated vapor at 5° is 8.149 cubic feet. The volume of one pound at the saturated pressure due to 5°, but at a temperature of 40°, is 8.84 cubic feet. The increase in volume is shown as follows:

$$\frac{8.84 - 8.149}{8.149} = 0.0848 = 8.48\%$$

For a given piston displacement or volume, it is evident that the weight of ammonia removed from the evaporator would be reduced by 8 48%, in this instance.

Amount of Ammonia to be Evaporated

The amount of ammonia to be evaporated in one minute to absorb heat at the rate of one ton of refrigeration per day of twenty-four hours, depends upon the refrigerating effect of one pound of the ammonia under the desired condition of pressures and temperatures. Generally, as previously indicated, the refrigerating effect may be taken to be the difference between the heat content of the saturated vapor leaving the evaporator coils, and the liquid just before the expansion valve, and at the saturated temperature corresponding to the pressure in the condenser.

It will be remembered that the absorption of heat at the rate of 288,000 B.T.U. per day, or 200 B.T.U. per minute, has been adopted as the standard ton of refrigeration. From Table 1, it will be observed that each pound of ammonia will take up heat according to the conditions, which will vary from 430 0 to 514 1 B.T.U. per pound. The amount of ammonia to be evaporated in one minute per ton of refrigeration would, therefore, be determined by dividing 200 by the various refrigerating effects. This is shown as follows:

$$m = \frac{200}{R}$$

where m = lbs. of ammonia per min. per ton of refr.

From Table 1, it will be observed that the refrigerating effect, when the saturated temperatures are 5° and 86°, is 474 3 B.T.U. per lb. The amount of ammonia to be evaporated under this condition would then be determined as follows:

$$m = \frac{200}{474.3} = 0\ 422$$

The amounts of ammonia to be evaporated at the saturated temperatures of 5° and 86° for both refrigerating and ice making purposes may be found as follows: Assuming that 1 6 tons of refrigeration are used to produce one ton of ice—

Ammonia per hour per ton refr. = $0\ 422 \times 60 = 25.32$ lbs.
Ammonia per day per ton refr. = $0.422 \times 1440 = 607.68$
Ammonia per hour per ton ice $= 25.32 \times 1.6 = 40.5$
Ammonia per day per ton ice $= 607.68 \times 1.6 = 972.29$

The determination of the amount of ammonia to be evaporated for the different suction and condenser pressures is the important factor in the design and construction of the refrigerating system. The exact amount of ammonia to be evaporated and circulated through the system will depend upon the suction and condenser pressures which, in turn, determine the available refrigerating effects of the ammonia. Table II., giving the pounds of ammonia to be evaporated per minute per ton of refrigeration was calculated from the values of the refrigerating effects shown by Table 1. The variations of the amount of ammonia to be evaporated per minute per ton of refrigeration under the assumed conditions are shown by Table II. An inspection of this table will show that there is no great variation in the amount of fluids to be handled. For the conditions in the table, the amount varies from 0 389 to 0 465 lbs. per minute per ton of refrigeration.

The usefulness of Table II. would be probably increased greatly, if the ice making and refrigerating plants were equipped with a reliable ammonia flow meter, that would indicate the amount of ammonia being handled by the refrigerating system. In the event that the ammonia meter would indicate the flow of ammonia in pounds per minute, or some other equivalent figure, the actual rate of producing refrigerating would be easily determined by use of the values shown in Table II. To do this, it would be only necessary to divide the flow as indicated by the flow meter, by the pounds per ton of refrigeration, as shown by Table II.

Compressor Piston Displacement

In order to make the compression refrigerating cycle continuous, the vapors produced by the boiling ammonia in the evaporator must be withdrawn immediately as they are produced. A uniform boiling temperature is maintained by keeping the pressure of the boiling ammonia at a constant value. As

TABLE II.—POUNDS OF AMMONIA PER MINUTE PER TON OF REFRIGERATION

Saturated Temperature of Liquid in Condenser

Sat. Temp. of Vapor in Evaporator	60° F.	65° F.	70° F.	75° F.	80° F.	85° F.	86° F.	90° F.	95° F.	100° F.	105° F.	110° F.
—40° F.	0.410	0.414	0.419	0.425	0.431	0.435	0.437	0.442	0.447	0.452	0.459	0.465
—35° F.	0.409	0.413	0.418	0.423	0.428	0.433	0.435	0.439	0.445	0.451	0.457	0.463
—30° F.	0.407	0.411	0.416	0.422	0.426	0.432	0.434	0.437	0.443	0.449	0.455	0.462
—25° F.	0.406	0.410	0.414	0.419	0.424	0.430	0.432	0.436	0.441	0.447	0.453	0.459
—20° F.	0.404	0.408	0.413	0.418	0.423	0.428	0.429	0.434	0.438	0.445	0.451	0.457
—15° F.	0.402	0.407	0.412	0.416	0.422	0.427	0.428	0.433	0.437	0.433	0.449	0.455
—10° F.	0.401	0.406	0.410	0.415	0.420	0.425	0.427	0.432	0.436	0.442	0.447	0.453
— 5° F.	0.399	0.404	0.409	0.414	0.418	0.423	0.425	0.429	0.434	0.441	0.446	0.452
0° F.	0.398	0.402	0.407	0.412	0.417	0.422	0.424	0.427	0.433	0.438	0.444	0.450
5° F.	0.397	0.401	0.406	0.411	0.415	0.421	0.422	0.426	0.432	0.436	0.443	0.448
10° F.	0.395	0.400	0.405	0.409	0.414	0.419	0.420	0.424	0.429	0.435	0.442	0.447
15° F.	0.394	0.399	0.404	0.408	0.413	0.418	0.419	0.423	0.428	0.434	0.441	0.446
20° F.	0.393	0.398	0.403	0.407	0.412	0.417	0.418	0.422	0.427	0.433	0.438	0.444
25° F.	0.392	0.397	0.402	0.406	0.411	0.415	0.416	0.421	0.426	0.432	0.436	0.442
30° F.	0.391	0.396	0.400	0.405	0.410	0.414	0.415	0.419	0.424	0.429	0.435	0.441
35° F.	0.390	0.395	0.399	0.403	0.409	0.413	0.414	0.418	0.423	0.428	0.434	0.440
40° F.	0.389	0.394	0.398	0.402	0.407	0.412	0.413	0.417	0.422	0.427	0.433	0.439

previously indicated, the relative weight of ammonia to be removed will depend upon the evaporating and condensing pressure and temperature. As soon as the weight of the ammonia to be evaporated is known, the corresponding volume may be readily calculated by multiplying the weight of ammonia by its specific volume. This is shown as follows:

$TD' = m \times V$

where TD' = theoretical disp. or volume of ammonia per min. per ton

m = weight of ammonia per minute per ton refr.

V = specific volume cubic feet per lb. of ammonia

The compressor, or similar device, must withdraw this volume of ammonia constantly in order to produce the refrigeration at the desired rate. When the ammonia evaporated at the saturated temperature of 5°F. and condenses at the saturated temperature of 86°, from Table II., it will be noted that the weight of ammonia to be evaporated per minute per ton of refrigeration under these conditions is 0.422 lbs. The volume of one pound of saturated ammonia vapor at 5° is 8.149 cubic feet. The corresponding volume of the ammonia to be removed, or the theoretical piston displacement, is calculated as follows:

$TD' = 0.422 \times 8\ 149 = 3.438$

The volume, 3.438, is the number of cu. ft. of saturated ammonia vapor which must be removed from the evaporator in order to produce a ton of refrigeration under the assumed conditions. This volume would be the corresponding piston displacement when the cylinder is assumed to have a volumetric or piston displacement efficiency of 100 per cent.

These theoretical piston displacements for various evaporating and condensing temperatures have been calculated and tabulated in Table III. From this Table, it will be observed that the theoretical displacement varies within wide limits, being comparatively small when the evaporating temperature is high, and the condensing temperature is low, and excessively high when the evaporating temperature is low and the condensing temperature is high, and varying from 1.546 to 11.55 cubic feet per minute per ton of refrigeration.

The corresponding values of the volumes in cubic inches may be calculated as follows:

$TD'' = TD' \times 1728$

where TD'' = theoretical volume or displacement in cubic inches per minute per ton of refrigeration.

These values have been calculated and tabulated in Table IV.

Volumetric Efficiency Due to Superheating

The volumetric or displacement efficiency of the ammonia compressor cylinder is the ratio of the volume of the ammonia actually removed, reduced to the conditions of the temperatures and pressures of the evaporator, to the volume of the piston displacement. The two principal factors which determine the true volumetric efficiency of the cylinder are the superheating and the clearance effects. The ammonia vapor entering the compressor cylinder during the suction stroke becomes superheated; that is, heated several degrees above the saturated temperature corresponding to the pressure, due to the absorption of heat from the hot cylinder walls, piston, and valves.

TABLE III.—THEORETICAL DISPLACEMENT OF COMPRESSOR, CUBIC FEET PER MINUTE PER TON REFRIGERATION

Sat. Temp. of Vapor in Evaporator	Saturated Temperature of Liquid in Condenser										
	60° F.	65° F.	70° F.	75° F.	80° F.	85° F.	86° F.	90° F.	95° F.	100° F.	105° F.	110° F.
—40° F.	10.180	10.280	10.410	10.560	10.710	10.810	10.860	10.970	11.100	11.250	11.300	11.550
—35° F.	8.860	8.942	9.055	9.160	9.270	9.380	9.420	9.510	9.620	9.770	9.900	10.050
—30° F.	7.715	7.752	7.785	8.000	8.075	8.190	8.225	8.283	8.400	8.512	8.623	8.760
—25° F.	6.760	6.822	6.891	6.975	7.058	7.159	7.190	7.255	7.340	7.440	7.540	7.640
—20° F.	5.925	5.988	6.060	6.135	6.208	6.280	6.291	6.368	6.428	6.529	6.620	6.705
—15° F.	5.215	5.280	5.344	5.395	5.475	5.540	5.550	5.616	5.670	5.760	5.824	5.902
—10° F.	4.611	4.668	4.715	4.772	4.830	4.888	4.910	4.968	5.015	5.084	5.140	5.210
— 5° F.	4.080	4.130	4.182	4.233	4.275	4.325	4.345	4 385	4.438	4.508	4.560	4.620
0° F.	3.626	3.661	3.717	3.754	3.799	3.845	3.863	3.890	3.944	3.990	4.046	4.100
5° F.	3.234	3.266	3.308	3.348	3.381	3.430	3.438	3.470	3.519	3.552	3.609	3.650
10° F.	2.887	2.922	2.959	2.988	3.025	3.062	3.069	3.097	3.134	3.178	3.230	3.266
15° F.	2.585	2.620	2.653	2.678	2.710	2.742	2.750	2.775	2.808	2.849	2.893	2.927
20° F.	2.322	2.352	2.382	2.405	2.434	2.464	2.470	2.494	2.523	2.558	2.589	2.623
25° F.	2.092	2.118	2.145	2.166	2.193	2.214	2.220	2.246	2.273	2.304	2.327	2.368
30° F.	1.886	1.902	1.930	1.954	1.978	1.998	2.003	2.022	2.046	2.070	2.099	2.128
35° F.	1.706	1.727	1.745	1.762	1.788	1.796	1.802	1.828	1.850	1.872	1.888	1.924
40° F.	1.546	1.566	1.582	1.597	1.618	1.637	1.642	1.657	1.677	1.686	1.724	1.745

TABLE IV.—THEORETICAL DISPLACEMENT OF COMPRESSOR, CUBIC INCHES PER MINUTE PER TON REFRIGERATION

Sat. Temp. of Vapor in Evaporator	Saturated Temperature of Liquid in Condenser										
	60° F.	65° F.	70° F.	75° F.	80° F.	85° F.	86° F.	90° F.	95° F.	100° F.	105° F.	110° F.
—40° F.	17610	17770	17790	18150	18520	18680	18770	18870	19080	19450	19540	19960
—35° F.	15320	15460	15650	15830	16020	16220	16280	16430	16620	16880	17020	17370
—30° F.	13340	13400	13600	13830	13950	14160	14220	14300	14520	14710	14920	15140
—25° F.	11680	11790	11910	12050	12190	12370	12430	12450	12690	12860	13030	13210
—20° F.	10240	10350	10470	10610	10720	10850	10870	11010	11120	11280	11450	11580
—15° F.	9015	9122	9240	9323	9460	9560	9580	9700	9800	9955	10060	10220
—10° F.	7972	8063	8150	8250	8345	8445	8483	8582	8683	8790	8880	9001
— 5° F.	7050	7140	7228	7318	7385	7455	7510	7580	7665	7790	7880	7981
0° F.	6268	6344	6422	6490	6565	6646	6680	6723	6819	6899	6992	7083
5° F.	5590	5642	5705	5784	5850	5925	5942	5999	6081	6140	6216	6319
10° F.	4990	5050	5113	5162	5230	5292	5305	5353	5420	5493	5582	5646
15° F.	4468	4520	4589	4628	4685	4740	4754	4800	4853	4925	5002	5058
20° F.	4018	4066	4120	4158	4219	4260	4270	4312	4363	4421	4473	4535
25° F.	3617	3660	3709	3744	3793	3828	3838	3881	3985	3985	4020	4091
30° F.	3261	3290	3335	3368	3419	3453	3462	3496	3535	3578	3628	3678
35° F.	2950	2985	3017	3045	3092	3105	3115	3160	3199	3236	3262	3325
40° F.	2672	2708	2733	2762	2797	2830	2838	2863	2900	2916	2908	3017

TABLE V.—VOLUMETRIC EFFICIENCIES DUE TO SUPERHEATING FOR VERTICAL SINGLE ACTING COMPRESSORS

Sat. Temp. of Vapor in Evaporator	Saturated Temperature of Liquid in Condenser										
	60° F.	65° F.	70° F.	75° F.	80° F.	85° F.	86° F.	90° F.	95° F.	100° F.	105° F.	110° F.
—40° F.	76.5	76.0	75.2	74.5	73.5	72.5	72.3	71.4	70.2	69.1	67.8	66.3
—35° F.	77.2	77.3	76.6	75.8	74.9	73.9	73.7	72.7	71.5	70.5	69.2	67.7
—30° F.	79.5	78.7	77.9	77.2	76.3	75.3	75 0	74.2	72.9	71.8	70.4	69.0
—25° F.	80.8	80.0	79.3	78.4	77.6	76,6	76.3	75.4	74.3	73.2	71.8	70.3
—20° F.	82.2	81.4	80.6	79.7	78.8	78.0	77.6	76.7	75.6	74.4	73.5	71.7
—15° F.	83.5	82.7	81.9	81.0	80.2	79.1	78.8	78.0	76.8	75.7	74.3	73.0
—10° F.	84.7	84.0	83.1	82.2	81.3	80.4	80.1	78.3	78.0	76.9	75.6	74.2
— 5° F.	85.8	85.1	84.3	83.3	82.5	81.5	81.2	80.4	79.3	78.1	76.7	75.3
0° F.	86.9	86.3	85.3	84.4	83.6	82.6	82.3	81.5	80.3	79.2	77.8	76.3
5° F.	88.0	87.4	86.4	85.6	84.7	83.7	83.4	82.5	81.4	80.3	78.8	77.3
10° F.	89.0	88.4	87.5	86.6	85.7	84.7	84.4	83.5	82.4	81.3	79.8	78.3
15° F.	90.0	89.3	88.3	87.4	86.6	85.6	85.3	84.4	83.2	82.2	80.7	79.2
20° F.	90.9	90.2	89.2	88.3	87.3	86.4	86.1	85.2	83.9	82.7	81.3	79.8
25° F.	91.7	90.7	89.8	88.9	87.8	86.8	86.6	85.7	84.4	83.2	81.7	80.4
30° F.	92.4	91.4	90.5	89.6	88.5	87.3	87.0	86.2	84.8	83.6	82.0	80.6
35° F.	93.2	92.1	91.1	90.1	88.8	87.6	87.3	86.4	85.2	83.7	82.3	80.9
40° F.	93.8	92.6	91.5	90.6	89.3	87.8	87.5	86.6	85.3	83.8	82.4	81.1

Being at a higher temperature than that corresponding to the saturation temperature in the evaporator, the ammonia vapor, therefore, at the end of the suction stroke, is at a temperature which is considerably higher than that of the evaporator, and therefore weighs less per unit volume.

The volumetric efficiency due to superheating seems to depend upon several factors such as the relative evaporating and condensing pressures, type and speed of compressors, etc. The true volumetric efficiency may also be affected by such factors as the wire drawing off the vapors through the valve, leakage past the valves and piston, etc. However, the latter factor may be reduced to comparatively small amounts.

The values of volumetric efficiency due to superheating for single acting compressors under various temperatures of evaporation and condensation, are shown by Table V. The values for the volumetric efficiency due to superheating in this table were derived from tests, and are really true volumetric efficiencies of slow and medium speed vertical single acting compressors. In these tests, however, the effect of clearance, leakage past the valves and piston, etc., were reduced to a minimum, so that the values represent principally the effect of superheating. The values of volumetric efficiencies, as shown by Table V., contain a factor of safety amounting to approximately 10%.

When the evaporating temperature is low, and the condensing temperature is high, the volumetric efficiency has its lowest value. For the conditions of −40° in the evaporator, and 110° in the condenser, the volumetric efficiency due to superheating is 66.3 per cent. On the other hand, when the evaporating temperature is 40° and the condensing temperature is 60°, the volumetric efficiency is correspondingly higher, namely, 93.8 per cent.

(To be concluded)

EXPANSION AT UNIVERSITY OF BRITISH COLUMBIA

The University of British Columbia, at Vancouver, is passing through an interesting period of its development at this time. Student organizations are undertaking a campaign for a larger immediate revenue, and are drawing some comparisons which show that university development has not been met as generously in B.C. as in other western provinces. It is demanded that the University be removed to Point Grey and a construction policy undertaken at once. Statistics for money spent to 1920 on various universities are available:

Province	Money spent to 1920	Students in attendance, 1920	Population of the Province
Alberta	$3,174,609	710	496,000
Saskatchewan	2,177,806	854	550,000
Manitoba	1,025,632	914	700,000
British Columbia	306,629	890	500,000

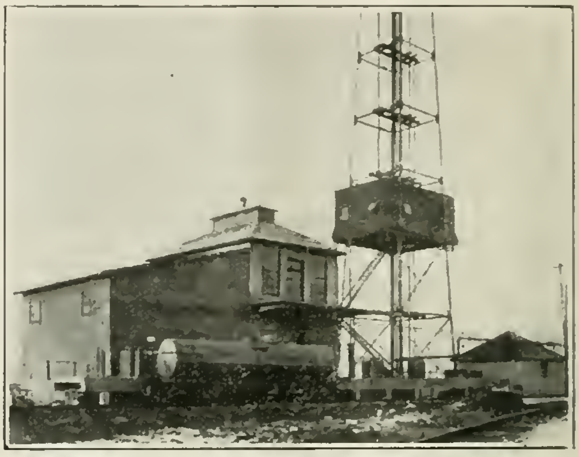
Nothing of any account has been spent since 1920 on the University of British Columbia, and this year the number of students is 1,178. In 1916—17, it was 378. The enrolment has increased over 200%, and the accommodation only 25%. This increase was not in permanent buildings. Chemistry classes, it is claimed, are meeting in tents, while classes are held regularly in a Baptist Church. Agricultural students are occupying a large private house. Some lecture courses are being repeated several times, and immediate facilities for faculties of law, commerce, medicine, dentistry, journalism and theology are required. It is estimated that the increase in attendance is permanent, and if facilities are granted, will show further growth.

Since the above was written, it has been announced by Premier Oliver, that construction of new university building will commence at once at Point Grey near Vancouver. Buildings commenced several years ago and partly erected will be completed as soon as possible. The first outlay on construction will be $1,000,000.

FIRST CANADIAN LIQUID CHLORINE PLANT

The installation of a liquid chlorine plant has just been completed at the chemical plant of the Canadian Salt Company, Limited, at Sandwich, Ontario, and this commodity is now being manufactured in the Dominion for the first time. The plant has been in operation for about a month, and is capable of producing 300 tons of liquid chlorine per month.

The Canadian Salt Company is fortunate in being ideally located for the manufacture of this article as the chlorine gas is obtained by the electrolysis of brine which is pumped from wells located on their own property. About 75% of the power used in this plant is supplied by the Hydro, from Niagara Falls and about 25% being generated at their own works, so as to obtain sufficient exhaust steam for evaporating and concentrating caustic soda, and thus, with the aid of Canadian labor, they are able to make a 100% "Made in Canada" article.



View of Liquid Chlorine Plant of Canadian Salt Company, Sandwich, Ont.

The liquifying process used is what is known as a partial refrigeration and pressure system. The concentrated chlorine gas as made in the Gibbs Cells is first dried by means of refrigeration and then passed through a forty-foot sulphuric acid tower to remove the last traces of moisture. The thoroughly dried gas is then subjected to approximately thirty-five pounds pressure, and afterward cooled to 20° below zero. The liquid chlorine as formed is conducted to large storage tanks from which it is packed into proper containers. For large customers it is shipped in fifteen tons, specially constructed tank cars, and for small customers, it is supplied in 150 pound cylinders.

The demand for liquid chlorine has grown tremendously during the past few years, the chief consumption being in the bleaching of sulphite pulp and for domestic water purification, laundries, etc. There are many other uses for liquid chlorine among which may be mentioned the manufacture or synthesis of organic compounds and textile bleaching, etc.

COAL OUTPUT OF ALBERTA

It is reported that Alberta's total coal output for the first six months of 1922, amounted to 2,401,266 tons, compared with 2,833,075 tons during the same period a year ago. The total output last year was 5,937,000 tons, while 1920 was the banner year for Alberta with 6,908,000 tons mined. The market in Manitoba is steadily developing. Last year it took a half million tons of Alberta coal, practically all domestic. Saskatchewan gets most of its import coal from Alberta, but still imports some anthracite from elsewhere.

The Development of Industrial Electric Heating for Low Temperature Enameling*

By Wirt S. Scott

Manager Industrial Heating Section, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

THE development of the electrically heated enameling oven within the past seven years is due to a concentration of effort on the part of electrical manufacturers and central stations upon a single industry—the automotive; and was accelerated by a willingness on the part of that industry to co-operate.

Previous to this development, the ovens were heated with gas, the burners being usually placed directly in the oven, and the heating being accomplished by the heated air of combustion bathing the work en route to the ventilation ducts placed in the roof of the oven. The ovens were poorly constructed, practically no attention being paid to thermal insulation, due to the low price of fuel. The art of enameling was extremely crude, the enameling departments being at the mercy of men who professed to possess so-called "trade secrets," the majority of whom knew little about the technique of enameling, and were at a loss to account for the large percentage of rejects that frequently occurred.

The first experiments made to electrify enameling ovens, consisted in placing makeshift electric heating units in old gas ovens. Practically nothing was known as to the chamical action resulting from the baking of enamels, hence the first effort was to duplicate the results then being obtained with gas. Enamels of the kind under consideration consist of an asphaltic compound carried in a suitable solvent with enough oil to make it resilient after baking. It was known that the solvent was driven off, and that the oils underwent oxidation, but practically nothing was known as to the ventilation problem involved. In burning the gas directly within the oven, an excessive amount of air was necessarily and fortunately introduced, automatically and unintentionally taking care of a condition that was not generally known to exist.

The first experiments using electric heat disclosed three points of advantage, namely, elimination of fires due to a combustible fuel, reduction in time required for baking, and a baked product having a smoother surface. Tests subsequently made by the research department of the Detroit Edison Co. revealed the fact that the baking in an electrically heated oven was accomplished largely by radiant heat, which seemed to penetrate the enamel quicker and to a greater depth than when heated by convection currents as in the direct gas ovens. The lack of products of combustion within the oven accounted for a cleaner product.

It was found, however, that the cost of operation was excessive as compared to gas, and knowing that a large amount of heat was being carried off in the vent ducts, it was thought that this source of loss could be eliminated, since no air was required for combustion. The first experiment consisted in closing up the oven as tightly as possible, and attempting to bake, but it was discovered that the enamel would not bake, regardless of the length of time that work was in the oven, but remaining in a "tacky" condition. This brought out the fact that a certain amount of air was required for oxidizing the enamel.

Overcoming Ventilation Difficulty

A continuation of these tests to determine the proper amount of air for oxidizing purposes resulted in a violent explosion of the oven, which almost completely demolished it. This forcefully brought attention to the composition of the enamel, which was found to consist of approximately fifty per cent. naphtha as a solvent for the asphaltum, which was distilled off as a gas. Most of the heating elements used at that time were operating at a temperature of approximately 900 F., (482 C.) hence it was thought that if heaters were designed to operate at sufficiently low temperature, the ignition of the naphtha vapors could be eliminated, and a restricted amount of ventilation be used.

A small test oven was constructed, electrically heated, with positive means for controlling the air entering, and the gases leaving the oven. Samples of many kinds of enamels were obtained and subjected to the same tests. These experiments consisted in placing a small vessel containing enamel within the oven, and with the inlet and discharge ducts closed, raising the temperature of the oven to a high temperature, cutting off the heaters to insure a stabilized uniform temperature within the oven, then opening the inlet and next the exhaust duct. Within a few seconds after opening the vent ducts, an explosion would occur. Similar experiments were made at reduced temperatures, with explosions in each case. Explosions were readily obtained at a temperature of 550 F., (288 C.) and in several cases, at the baking temperature of the enamel itself, demonstrating the impracticability of attempting to operate with a heating element of sufficiently low temperature to eliminate the possibility of explosions when restricting the ventilation.

During these tests, it was noted that after each explosion the flames appeared to burn from the floor. It was first thought that this was the result of the enamel being blown out of the container, but more thorough investigation disclosed that the flame was due to the ignition of the volatile gases, which appeared to settle on the floor. Tests were then made to determine definitely the action of the volatile gases within the oven, and it was found that they were heavier than air, and would first descend to the floor, filling up the oven like so much water. The gases were driven off very rapidly upon heating, consequently, before the baking temperature was reached, the mixture within the oven would be too rich to explode. Upon releasing some of the gas and admitting fresh air, the proper explosive mixture would be obtained. Under normal conditions of ventilation, the gases, after descending to the floor, would become heated, and ascend to the roof, passing out through the vent duct.

As a result of these tests, the following facts were established:

1. With restricted ventilation, explosions were possible in enameling ovens, regardless of the temperature of the heating element.
2. A sufficient amount of air must be admitted to the oven to keep the mixture "lean," or sufficiently dilute to make an explosion impossible.
3. The vapors should be withdrawn at or as near the floor as possible.

The first oven to be put in operation using the floor method of ventilation was also equipped with the roof method of ventilation in case the former failed, or it was found necessary to use a combination of both. Air was admitted back of the heaters. Tests not only showed that it was possible to ventilate from the floor, but that it was the proper way of ventilating when volatile gases must be removed. Repeated tests showed that one-third less air could be used when ventilating from the floor, and that the length of time required for baking was reduced twenty-five per cent.

The reduction in the time required for baking was not an unlooked for advantage. Heaters, as well as gas burners, were restricted as to location within the oven. The work, after being dipped or sprayed with enamel, is allowed to drip or "set" before entering the oven. Upon heating, the enamel softens, and a certain amount flows off, dripping on the floor. Heaters placed on the floor under the work would soon be covered with enamel, the coking of which would ultimately cause a fire, even

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*A paper presented at the Forty-second General Meeting of the American Electrochemical Society, Montreal, September 21-23, 1922.

Manuscript received August 19, 1922.

if the enamel did not ignite immediately when coming in contact with the heating element. For this reason it was found advisable to place the heaters along the side wall, but as near the floor as possible. With heaters placed in this position, and ventilating at the roof, the direct path for the heated air was up the side walls, across the roof, and out. This left a large space in the middle of the oven difficult to heat, the work necessarily remaining in the oven until that space was heated. In order to heat the coldest portion of the oven up to the desired temperature, the other parts had to be considerably overheated, which was not evident since the thermometer bulb was placed in the door, the coldest part of the oven. Ventilating from the floor, the heated air passed up along the side walls across the roof, and down through the middle of the oven, and out, producing a much more uniform distribution of temperature by bringing the hot air through the middle of the oven and down to the cold floor.

Simultaneous with these tests, oven builders were being interested in designing and building better insulated ovens, and it was soon demonstrated that an oven having four inches of high grade insulation was a paying investment over one having 1.5 inches of poor insulation, which was then standard practice.

Furthermore, attention was called to the enormous amount of through metal in the form of bolts and channel iron extending from the inside to the outside of the oven, which in many cases accounted for fifty per cent. of the entire radiation loss. This, in course of time has been reduced to a large extent, consistent with good mechanical construction.

Improvements in Heater Connections, Temperature Control and Ventilation

Electrical manufacturers began to appreciate the difficulties encountered in oven work, and to design heating elements specially adapted to ovens. Approximately ninety-five per cent. of all electrical troubles occurred in the terminals or connectors. Copper wires were first used to connect the heaters, the method for making the connections being left largely to the skill and imagination of the electrician doing the work. Bus bars were substituted for wire, aluminum bus bars for copper, and finally cold rolled steel bus bars were adopted, which has now become standard practice.

In adopting the cold rolled steel bus bar construction, an important step was made in the development of the heater, by a design which permitted the bus bars to be mounted directly on top of the heater, on insulators, attached to the heater frame, and having standard cold rolled steel connectors of sufficient shapes and combinations to permit an installation of the complete equipment within the oven by a workman using only a wrench.

One of the most important developments was that of automatic temperature control for the ovens. Magnetic contactors were in use in connection with the operation of motors, and were first used in connection with ovens as remote controlled circuits, using "on" and "off" push button stations inserted in the magnetic coil circuit. Mercury and vapor tension thermostats were in use for indicating temperature or ringing alarm bells, to which were added adjustable "high" and "low" contact hands, controlling the temperature through definite limits. Suitable relays were added so that the "making" or "breaking" of the high or low contact on the thermostat would cause the main magnetic contacts to open or close, as the case may be, depending upon the temperature within the oven.

Small ovens, 100 Kw. capacity and under, usually have the heaters all placed on one circuit, which is automatically controlled. In many installations, and particularly in larger ovens the heaters are divided into two or more circuits, one of which may be a constant heat circuit not actuated by the thermostat, and of slightly less than sufficient capacity to maintain the radiation and ventilation losses, or in other words, to maintain the operating temperature without any work in the oven. The rest of the heaters are placed on a temperature control circuit, and are cut on and off automatically as may be required to maintain uniform temperature.

Natural ventilation was used entirely with gas ovens, and for a considerable time with electric ovens. It was found, however, that on certain days a longer length of time was required for baking than on others, and investigation showed this to be due to atmospheric conditions. Investigations also showed that many explosions of gas ovens had occurred on such days, as the result of insufficient ventilation. In ventilating electric ovens from the roof, twenty changes of air at room temperature was figured as sufficient, but later when using the floor method of ventilation, ten changes of air at oven temperature was estimated to be sufficient to keep the volatile gases sufficiently dilute to prevent explosions.

With atmospheric conditions affecting the amount of air entering the oven, it was necessary to provide positive means of insuring a definite amount of ventilation at all times. Furthermore, it was difficult for oven builders to design the ventilating system so as to give the required number of changes of air per hour, the tendency being to err on the safe side, with the result that in most cases, under normal conditions, an excess amount of air was entering the oven, causing an excessive loss, and low efficiency of operation. To provide for these conditions, motor driven exhaust fans were used for exhausting a definite amount of air per hour from the oven, insuring positive ventilation, provided the exhaust duct remained open to the atmosphere at all times.

In the baking of enamels, there is given off, in addition to the volatile vapors, a vapor containing oil and asphaltum compounds, in the form of a brown smoke. A tarry substance condenses from this vapor upon reaching a temperature below its distillation point, which is usually at some part of the vent duct external to the oven. This substance solidifies, cokes, and in course of time will gradually fill up the duct unless means are taken for keeping the ducts clean. The gradual restriction of the cross section does not become apparent, and has resulted in many disastrous explosions.

In order to eliminate the possibility of explosions due to vapors condensing and solidifying in the vent ducts, a system has been perfected, which, in connection with a motor driven exhauster, automatically shuts off the power the instant the exhaust duct becomes restricted in any manner, or in the event the runner of the exhaust fan becomes loose on its shaft, as happened in one case.

When electrically heated ovens first came into use, gas ovens were being operated at temperatures from 300 to 350 F. (149 to 176 C.), and the baking period was from three to four hours. With electric ovens the baking period was reduced to less than one-half, and with enamels baking at 450 F. (232 C.) the baking period was reduced to one hour, and in some cases to thirty minutes. However, too short a bake is injurious to the enamel, since the vapors are driven off too quickly, not allowing the enamel sufficient time to flow smoothly, also causing craters, due to the rapid expulsion of the vapors, which craters do not have time to heal over before hardening.

Proper Baking Requirements

In the proper baking of enamels, it is essential that the work and the enamel be heated uniformly, hence the larger the mass the slower it should be brought up to its maximum temperature. Enamel on being heated softens and tends to flow. In fact, it will flow excessively if the heating is done rapidly. A certain amount of softening is essential to produce a smooth finish, but actual flowing and dripping of the enamel off the work should be avoided, since that is not only a waste, but results in lumps being formed at the points where the dripping takes place.

Two things are essential in the baking of enamels, a uniform protective coating of enamel, and maximum adhesion between the enamel and the work. The greatest amount of adhesion and the thickest and smoothest surface of enamel is obtained when the work is heated at such a rate as will permit the metal to become uniformly heated at the same rate as the enamel on its surface. Many defects in enameling are traceable to ignoring or being in complete ignorance of this fact.

In one suitable type of continuous conveyor type oven for baking enamel on typewriters, fans, small motors, automobile license tags, small castings and sheet metal work of various sizes and shapes, the work is hung on the conveyor, and is carried over a pulley down into a tank filled with enamel, up and down through a dripping space and then through the oven. The conveyor travels in an up and down direction as it progresses through the oven, returning near the floor and under the heaters. Automatic temperature control is essential to the successful operation of this type of oven.

Much trouble is experienced by manufacturers of automobile fenders, with the rivets and heavy rims coming out of the oven bare or only partly covered. The cause is usually attributed to oil or grease and to improper cleaning, and after more thorough cleaning of the parts, it is found that the trouble has not been appreciably remedied, the bare spots having to be touched up by hand. The real cause is due to the work being run into a hot oven or subjected too rapidly to a high temperature, the sheet metal heating up rapidly but the rivets and heavier parts lagging in temperature sufficient to permit the enamel to flow entirely off that part.

In one installation, where a continuous conveyor type oven was used for fenders, the work had been coming out of the oven with practically all the rivets bare. There were also bare spots on the sheet metal. These bare spots had been attributed at first to improper cleaning of the fenders, but after trying many remedies, it was evident that the trouble was due in some way to the heating process. An investigation of the oven while in operation revealed the cause of the bare spots on the sheet metal work.

The oven was of the elevated tunnel type, with an approach rising to a height of approximately eight feet, in a distance of fifteen feet. Ventilation was accomplished at the floor line, one outlet being half way up the approach, one at the end, and one in the centre of the oven. The heavy tarry vapors were being drawn into the unheated approach, where the walls were found to be covered with the condensate, showing that the walls were at a lower temperature than the vapor. The condensate on the ceiling was dripping down on the work, and wherever it struck, the enamel was washed off clean.

A horizontal approach twenty feet long was added to the inclined approach, and one-third of the heaters taken out of the oven and placed in the inclined approach, producing a long preheating chamber and a baking chamber. The first batch of work coming through the oven after this change not only had no bare spots on the sheet metal work, but every rivet on the fenders was perfectly covered with enamel. The proper preheating of the work had solved the problem entirely.

In another instance where a semi-continuous conveyor oven was used, the work was run immediately into a hot oven, the baked work passing out the opposite end as the green work entered. The oven temperature dropped from 450 to 300° F. (232° to 149° C.) while the change was being made, due to the rapid absorption of the heat by the work. A bake was obtained in thirty-five minutes. Practically fifty per cent. of all rivets on the fenders came out bare. So many fires and explosions had taken place in the ovens that if an alarm was turned in, the works fire department immediately made a dash for the enameling department without looking to note on the indicator the location of the fire, feeling sure that the ovens were on fire again.

As soon as the baked work was run out of the oven, it was taken off, dipped, and hung back on the conveyor for the second baking. The last pieces were finished at about the time the bake in the oven was completed, consequently, the work did not have sufficient time to drip before entering the oven. To make matters worse, heaters had been placed on the floor, in addition to those along the sides, in order to accelerate the rate of baking. The heaters were covered with baffle plates, but the green enamel dripping on the hot plates took fire readily.

The explosions were due to driving off the volatile gases too fast for the vent ducts to handle them properly. The naphtha vapors begin to come off at room temperature, and for best results, should be entirely liberated by the time a temperature of 250° F. (121 C.) has been reached. Therefore, it is evident, if the work is placed immediately in an oven having a temperature of 450° F. (232° C.) and the heat turned on, the gases will be generated at an enormous rate.

The difficulties above experienced were entirely overcome by removing the heaters from the floor, lengthening the bake to fifty minutes, and not turning on the heaters until after the work had been in the oven for fifteen minutes. By the end of that time, the oven had dropped to a temperature of 225 F. (107 C.), and all the volatile gases had been driven off with entire safety. The work also had fifteen minutes longer to drip outside the oven. The net result was the elimination of fires and explosions; the preheating allowed the enamel to adhere properly to the rivets; less enamel flowed off the fenders, due to greater length of time allowed for dripping and setting of the enamel in the air, also due to pre-heating; the finished product had a much smoother and higher gloss finish.

The electrification of enameling ovens has permitted the liberation of an enormous amount of heat in an oven in a very short period, consequently, with the necessity for production confronting the user, he is apt to attempt to speed up the baking operation to the limit. The man responsible for the capacity and type of equipment being installed may not have sufficient information in connection with that particular plant operation to predict exactly the results finlly obtained. For this reason it is sufficient to convince a customer that he should purchase electrically heated ovens, and obtain his order, but it is even more essential that an inspection be made of the installation when in operation and results obtained, for the purpose of assuring the success of the entire operation.

Before the adoption of electric heat, oven operations were practically limited to batch processes, due to the difficulty in controlling the temperature, securing and maintaining the correct temperature distribution. The use of electric heat has been responsible for the development of continuous conveyor type ovens of all types, shapes and forms to fit in best with a manufacturer's particular process or location.

Installation of Electric Ovens at Cadillac Motor Car Co.

The installation of electric ovens at Cadillac Motor Car Co., Detroit, Mich., is an example of the development of the art of baking enamel on automobiles, and is a tribute to the work of the pioneers in industrial electric heating. This magnificent installation also shows the confidence of a large automobile manufacturing company in the superiority and economy of electric heating.

The ovens are designed for a capacity of 100 cars per nine-hour day, 26,000 pounds (11,793 kg.) of work being baked in four ovens each hour. The ovens are the continuous conveyor tunnel type, elevated so as to allow an inclined entrance and exit to give an air seal at each end. The work is hung on the conveyor, is dipped automatically in enamel, and passes through four ovens in succession, the dipping each time being done automatically.

In the first half of each oven, the heaters are placed along the side walls, and approximately three-fourths of the total amount of the air required for ventilation is exhausted from this section, at the floor line. In the second half of the ovens, heaters are placed on the floor, the ventilation in this portion being partly from the floor near the side walls, and partly from the ceiling. Heaters along the side walls are protected by wire screen, and those on the floor by sheet metal baffle plates, in case any pieces of work should fall off the conveyor in passing through the oven.

The amount of air required for ventilation in each oven was accurately determined as follows: Samples of the enamel were analyzed to determine the amount of solvent present. A definite amount of solvent vapor and air was injected in a small test oven, completely filling it, and attempts made to ignite it by means of an arc from a spark plug placed in the centre of the oven. The reasons for using an arc as a basis for these tests is based on the fact that in any electrical installation, an arc is apt to occur, and should that condition exist, it is essential that the gas mixture within the oven be sufficiently lean to make an explosion or fire impossible.

It was found that a mixture of 92 per cent. air and eight per cent. solvent vapor (both percentages by weight) would cause an explosion of a mild form. A mixture of 93 per cent. air and seven per cent solvent vapor would take fire but not explode. A mixture of 94 per cent. air and six per cent. solvent vapor could not be made to take fire. Allowing for an ample factor of safety, a mixture of 95 per cent. air and five per cent. solvent vapor was recommended. As the percentages of solvent vapor increased, the explosions increased in violence until they reached a maximum with 85 per cent. air and fifteen per cent. solvent vapor. Increasing the solvent vapor beyond this point, the explosions became less violent due to a resultant rich mixture, but it was found that in such cases, the amount of oxygen present in the air was not sufficient to oxidize the enamel in baking.

Each oven is twelve feet (3.6 m.) wide and eight feet (2.4m.) high. The conveyor travels at a speed of two feet (60 cm.) per minute. The maximum temperature in the baking zone of the oven is held constant at 450° F. (232° C.). Heaters are arranged to give a gradual rise of temperature up to the maximum required.

Oven No. 1 is 84 feet (25.6 m.) long over all, equipped with 156 heaters giving a total capacity of 390 Kw. Two constant heat and two temperature control circuits are used.

Oven No. 2 is 114 feet (34.7 m.) long over all, equipped with 168 heaters, giving a total capacity of 420 Kw. One constant heat circuit and three temperature control circuits are used.

Oven No. 3 is an exact duplicate of oven No. 2.

Oven No. 4 is 134 feet (40.8 m.) over all, equipped with 180 heaters, giving a capacity of 450 Kw. One constant heat circuit and four temperature control circuits are used.

ELECTROCHEMISTS TO DISCUSS ELECTRODE POTENTIALS AND PRODUCTION OF RARER METALS

The 43rd Semi-Annual Meeting of the American Electrochemical Society will be held in New York City, Hotel Commodore, May 3, 4, and 5, 1923.

The principal attractions of the technical program will be a whole day session on the general topic:

"The Production and Application of the Rarer Metals."

The arrangements for this session are in charge of Dr. F. M. Becket of the Electrometallurgical Corporation, New York City. There will be papers on vanadium, tungsten, cobalt, molybdenum, zirconium, cerium, uranium, tantalum, calcium, magnesium and others.

Another session will be devoted to a discussion of "Electrode Potentials," headed by Dr. Wm. G. Horsch, of the Chile Exploration Co., New York.

FOREIGN STUDENTS AT McGILL

Of the 671 new students enrolled at McGill University, American-born students number 94, 31 being from New York, 9 from Massachusetts, 8 from Pennsylvania, 5 from Maine and 5 from Rhode Island. Russia contributed 40 students, Poland 8, and other continental European countries 10. Three come come from South America, 2 from Palestine, and one each from China and Japan.

Chemical Society News

Containing Official Announcements of the Canadian Institute of Chemistry.

ORGANIZATION OF WESTERN ONTARIO SECTION, C.I.C.

At a most enthusiastic meeting, following a dinner at Hart House, the local members in the vicinity of Toronto organized the Western Ontario Section of the Canadian Institute of Chemistry.

Previous to the meeting, practically all members of the Institute in Toronto attended a dinner in one of the several private dining-rooms of Hart House. The meeting was called to order by Prof. E. G. R. Ardagh, F.C.I.C., local vice-president. Some twenty-seven were present. The officers of the new branch are H. M. Lancaster, F.C.I.C., chairman; Dr. B. McCallum, F.C.I.C., secretary, and W. K. McNeill, F.C.I.C., treasurer.

A general discussion followed, in which future activities and policies were outlined. It is anticipated that practically all members in Toronto and Western Ontario will wish to become associated with this section, and a strong effort will be made to increase the membership among all properly qualified professional chemists in this district. Following the general plan of Provincial organization, this Western Ontario Section will be part of the Ontario Branch.

Following the organization meeting, a most interesting account of some recent research work in the pulp and paper field was given by Mr. D. A. Scott, A.C.I.C.

The enthusiasm of the members regarding the field for Institute work was a conclusive indication that this will become a most active Section. The discussion following the paper, Indicated that the members are very much interested in hearing reports of progress in research work, when presented in technical and chemical detail. The new professional spirit among chemists is making rapid progress within the Institute.

QUEENS' STUDENTS HEAR ADDRESS FROM FORMER "GRAD."

On Friday afternoon, November 3rd, under the auspices of the Students' Branch, Canadian Institute of Chemistry, an address was given in Gordon Hall, Queen's University, Kingston, by Mr. E. T. Sterne, Science graduate '13 of Queen's, on "Explosives and Canada's Part in the Great War." The address proved both instructive and entertaining to a large degree.

The speaker first dealt with the history of explosives, and then described the manufacture of the various explosives known. In this connection he stated that the original research conducted in Canada just prior to, and during the great war was of immense value to the Allies.

Following this, he summarized the production of explosives in Canada during the late war. At the beginning, Canada was only producing about three thousand tons per month. Towards the end of the war, the production had been increased to several million tons, the British Chemical Co., at Trenton, of which Mr. Sterne was Manager, heading the list with twelve hundred thousand tons. It might be interesting to note that the British Chemical Co., at Trenton, was the only plant in the British Empire that manufacture explosives complete. Mr. Sterne concluded by stating that it was this largely increased production of Canada that was a determining factor in the great war.

Mr. Sterne is now technical director of G. F. Sterne & Sons, Limited, Chemical Manufacturers and importers, Brantford, Ont.

PRIZE ARTICLE ON CHEMISTRY

As announced in November issue, two prizes amounting to $50.00 and $25.00 have been created for the two best articles accepted by Canadian publications with national distribution. The nature of the articles considered of most value in this connection has already been outlined along with other regulations connected with the competition. Members of the Institute who anticipate competing should send in their names to the Secretary of the Institute at 57 Queen St. W., Toronto. Remember the competition is open until May 1st, 1923. A splendid opportunity for the development of some good publicity is presented and the Council of the Institute anticipates that a large number of members will take an active part in the competition.

NEW MEMBERS, CANADIAN INSTITUTE OF CHEMISTRY

Associate (A.C.I.C.)

Ira Wallace Clarke, Bear River, N.S.

(Transferred From Student to Associate Membership)

Albert Harold Heatley, Electrochemical Laboratory, University of Toronto, Toronto, Ont.

Student Members (Queen's University)

R. D. Campbell, Queen's University, Kingston, Ont.
Francis H. Chapman, 25 First St., Kingston, Ont.
Albert L. Kuehner, 232 Brock St., Kingston, Ont.
John Chisholm MacLeod, Queen's University, Kingston, Ont.
Leo Marion, 161 Division St., Kingston, Ont.
H. F. Melvin, 201 University Ave., Kingston, Ont.
Arthur M. Leveau, 382 Johnston St., Kingston, Ont.
A. S. Townshend, 249 Barrie St., Kingston, Ont.
Ossian E. Walli, 57 Union St., Kingston, Ont.
H. H. Wells, 23 University Ave., Kingston, Ont.
Harry Cox, Queen's University, Kingston, Ont.
Gordon W. Denike, 142 Stuart St., Kingston, Ont.
A. J. Strain, Queen's University, Kingston, Ont.

DR. A. McGILL

The retirement recently, of Dr. Anthony McGill marks the passing from active work, of one of Canada's best known chemists. Dr. McGill was for many years head of the Laboratories of the Department of Inland Revenue, administering food and drug standards and a variety of acts calling for chemical control of products in industry. Much of this work is now under the Department of Public Health.

He was born at Rothesay, Scotland, on April 18, 1847. His parents were the Rev. A. McGill, of Argyle Square Chapel, Edinburgh, and Katherine (Ross) McGill. As a very young man, he came to Canada, and taught in public schools in Perth County and Lake Simcoe districts. He attended the Hamilton Grammar School and Toronto Normal School. He graduated from the University of Toronto in 1880, with the B.A. degree, and from Victoria College in 1882, with the B.Sc. During this period, he was assistant to the late Dr. Hodgson Ellis. For a time, he was Science Master at the Collegiate Institute, Ottawa, and developed a consulting chemical practice. He became assistant chemist in the Department of Inland Revenue, in 1887, under the late Dr. G. McFarlane, and, in 1907, became Chief Analyst. He was honored with the LL.D. by Ottawa University in 1910, and has been a member of the Royal Society of Canada for many years.

As a chemist, he developed the work in food and drug standards practically from 1887, which marks the time when a more active interest was taken in this by the Government. Government reports dealing with these matters, and prepared under his direction now number several hundred.

During the thirty-four years that he has been engaged in this work, it was his pleasure to see his department grow from one employing some two chemists to one with four branches outside Ottawa and a staff of nearly twenty.

His work brought him in touch with manufacturing interests of all kinds, and in this connection he always displayed most diplomatic accomplishments and was held in high regard by ministers of his department. Those who worked with him had an opportunity to see a blending of characteristics and qualities rarely found in recent graduates in Science. Dr. McGill was as much at home delivering a lecture on some phase of English poetry or literature, as he was when discussing chemistry. His was the dual opportunity, not now given to all of us, of having as a background for his science a training in general literary culture along the lines deemed wise fifty years ago.

While he has left active work, we know he will be looking forward still to years of study and enjoyment. He loves the big outdoors; and although he is taking up his residence in the United States, we trust that he will be able to return frequently to meet with those who have worked with him, and those who esteemed his labors in the field of Canadian Chemistry, which he advanced so far.

DR. RUTTAN ADDRESSES MONTREAL SECTION S.C.I.

The first meeting of the Montreal Section of Society of Chemical Industry for the season of 1922-23 was held at the Queens Hotel on Monday, October 16th. The guest of the evening was Prof. R. F. Ruttan, past-president of the Society, lately returned from the annual meeting held at Glasgow.

In describing the various social gatherings prior and incidental to the annual meeting, Dr. Ruttan distributed some souvenirs of the functions, consisting of programs, menus, and photographs illustrating the international and comprehensive character of these meetings.

The absence of a publication devoted to popular science was a most unfortunate situation in England, in Dr. Ruttan's opinion. He voiced this sentiment publicly abroad, and urged that steps be taken to inaugurate a popular official magazine which would serve to educate the public along scientific lines, similar to the practice in vogue on this continent. The lack of such periodicals in the British Isles is nothing short of astounding to a scientist from this country where such propaganda has won such general appreciation of the value of science to the community.

Coupled with this unfortunate state of affairs is the hiatus between the universities and chemical industries at large. Canada and the United States present a very sharp contrast in this respect. Dr. Ruttan deprecated this condition also, pointing out that close co-operation between the university and industry is not only mutually beneficial, but absolutely necessary to promote the best interests of the country. He referred to the extensive calls from the industries during recent war-time necessities for scientific assistance in research. Such help was furnished in a measure by the universities. At the present time, however, this great system of co-operation has notably diminished by the recurrent widening of the gap between these two national institutions. Many of the university men are losing their interest in industrial affairs and are thus creating a situation which is to be nationally regretted.

The question of "The Training of the Chemical Engineer" which was the theme of Dr. Ruttan's address before a large meeting of chemists in London, became the subject of animated debate, and the attitude adopted towards the profession of chemical engineering was very surprising. It is apparently a prevalent idea in the Old Country, that a graduate in general engineering can acquire enough chemistry to serve his requirements at any time after graduation, provided of course he has had the usual elementary courses in general chemistry prerequisite to the ordinary engineering degree. Such a narrow view point is altogether at variance with the principles embodied in the curricula of our universities on this continent for chemical engineering students. In answer to such contention, Dr. Ruttan raised the question: "How is an engineer with only elementary knowledge of general chemistry going to cope with a complex problem in advanced organic engineering chemistry?"

The whole course leading to a degree in chemical engineering in England, is only three years. As necessary to the thorough training of the chemical engineer. Dr. Ruttan is the sponsor for the advocacy of establishing a fifth year in this course. The extra year would be spent extra-murally in some appropriate industry and the activities of the candidate would be under careful and thorough supervision. In addition to this practical work he would be required to attend a series of graduate lectures. Thus he would be enabled to consolidate and correlate his theory and practice,—a consummation which is open to question under the present regulations. The work of this fifth year would be along lines somewhat parallel to a medical clinic.

The lecturer called attention to some changes which are of special interest to members of the Society in Canada. The first was the preparation of a complete list of the members of the Society in Canada, each with his proper address. This list has been distributed to all the Canadian members, and will be useful for reference.

Secondly, the change in the typography and extent of the portion of the Journal devoted to a Review of matters of general interest to chemists. Formerly this occupied only two or three pages; it is now extended to ten or fifteen, and printed in larger type, making it much more attractive and readable. It is further proposed that the review in 1923 be issued weekly to every subscriber, and every second number would be issued with the Transactions, Abstracts, Patent Literature, etc., as at present. This would practically give every member of the Society a weekly chemical journal, which would deal broadly with questions of interest to chemists.

The lecturer referred to the international character of the meeting at which the Franklin Medal, from the Franklin Institute in Philadelphia, was presented to Sir Joseph J. Thomson. The presentation was made by Lord Balfour and Sir Joseph's reply consisted of an eulogy on the life and work of Benjamin Franklin as a pioneer in several important fields of science.

Dr. Ruttan then announced that during the summer, arrangements had been completed for the publication of an International Journal of Physical Chemistry, under an editorial committee consisting of four from America and four from England. The American Journal of Physical Chemistry, supported and edited for so many years by Professor Bancroft, of Cornell, would now be discontinued and in all probability Professor Bancroft would be the unanimous choice of the Board as editor of the new journal. This plan of publication received the unqualified support of the American Chemical Society, the Society of Chemical Industry, the English Chemical Society, and the Faraday Society.

The lecturer in conclusion, expressed his high appreciation of the warm welcome he had received from the chemists of England and Scotland, as the first Canadian President of the Society.

During the progress of the meeting, the report of the Bursary Committee was presented by Mr. A. Neighorn. This Committee was empowered at the last meeting of the local section to deliberate upon and discuss with Dr. Ruttan the advisability and method of application of a sum of money in the form of a bursary to students in the chemical engineering course entering upon the Fourth Year at McGill University.

The result of this conference was to the effect that the local section should present the sum of $50.00 each year to the student entering upon the Fourth Year of his course, who submitted the best essay on his practical summer work in the judgment of the Committee of the Faculty appointed for this purpose. The resolution embodying this recommendation was unanimously adopted by the meeting. In the name of the University Dr. Ruttan thanked the members for this interest in the chemical engineering course of the University which he represents.

FUEL PROBLEM DISCUSSED BY OTTAWA SECTION S.C.I.

"Domestic Fuel Problems" was the subject under consideration at the first meeting of the Ottawa Section, Society of Chemical Industry, held Thursday evening, November 9th, at the Daffodil Tea Rooms, Ottawa. The subject was divided under three heads:—"Characteristics of Different Types of Fuels," by Messrs. R. E. Gilmore, J. H. H. Nicholls and H. Kohl, superintendent and engineering chemists respectively, of the Government Fuel Testing Laboratory, Ottawa; "Types of Domestic Furnaces," by E. S. Malloch, fuel engineer, Department of Mines, Ottawa; and a general discussion on "How to Heat the Home," participated in by all members.

The subject of household fuels was divided into three parts, viz. (a) The relative value of chemical and physical analysis of coal and other fuels; (b) The classification of the higher types of fuels, and (c) The ignition temperature of different fuels. A synopsis of what was said is as follows:—

Chemical analysis involves the determination of moisture—ash volatile matter and fixed carbon. The moisture and ash determination tell what quantity is not real fuel—the volatile matter indicates whether the fuel is smoky or not, and the fixed carbon shows how much coke or charcoal a given fuel will yield. The cooking properties are also determined and expressed in B.T.U. (British Thermal Units) per lb. The cooking properties are also generally significant.

Physical Analysis

Physical analysis includes the handling, storage and burning qualities.

Although the general value of a fuel can be appreciated once its physical properties are known, chemical analysis serves the purpose of telling to what class a given coal or fuel belongs. The classification of coals into anthracites, semi-anthracite, semi-bituminous, etc., is accomplished by chemical analysis but this must not be done without taking into account the physical characteristics and peculiarities. If, with a chemist's certificate of anlysis were forthcoming an interpretation of the results of analysis, the layman and even the semi-technical man would place more value on chemical analysis than is generally the case.

Welsh coals, it was pointed out, were comprised of at least four different grades, and it is chemical analysis along with physical characteristics that can distinguish and pick out the best grades. The trouble with Welsh anthracite is evidently not its chemical properties, but its physical properties in respect to hardness. Indications are that if the best grades of Welsh anthracite are screened and graded before going to the consumer, it would be equal, if not better, than the best grade of Pennsylvania anthracite. American anthracite is, however, considered the standard household fuel, and as long as the supply is available, it looks as if the price factor will control its use.

Substitutes other than Welsh coal are metallurgical and gas coke, peat, hardwood, and even soft coal. Soft coals can be used, and probably more economically than hard coals, but we will likely need radical changes in the design of our furnaces to avoid the disadvantages of the smoke nuisance.

Mr. Malloch in his address on "Types of Domestic Furnaces" described briefly the work being carried out at the Government Fuel Testing Station with an ordinary hot water furnace on different types of fuels. At present the work was confined for the most part to the comparing of efficiencies of different household fuels. The comparative efficiencies of different types of furnaces will be considered later.

Welsh anthracite coal, with less than six per cent. ash and excellent heating qualities was given a clean bill of health by Mr. Malloch, except for the fact that it contains too much "fines", amounting to forty per cent. He, in addition, during his interesting treatise on methods of firing, brought out another point worth knowing, viz., that the fire grid in the fire door should never be entirely closed. He warned also, that those who have hot water furnaces and sleep with their windows open at night, must wrap up their radiator so that the cold air shall not chill the water content of the radiators and nullify the attempts of the furnace to heat the house. He caused some surprise when telling of his experience in the burning of peat, he said that peat ashes had kept their heat for three days and had set fire to paper when deposited on it. Mr. MacIntyre, in commenting upon this unusual feature, said it was due to carbon ignition, and not from the ashes.

There was plenty of interesting discussion. Dr. W. E. MacIntyre strongly criticized the present day construction of houses, which, he stated, was at the root of inefficient heating. The check damper in the flue should not be there, he said, and should never be closed.

Dr. F. T. Shutt believed that the only remedy in overcoming the difficulties encountered in burning soft coal in domestic furnaces was to mix coke with it, as suggested by Mr. Malloch.

Mr. F. J. Hambly, chairman of the Section, presided.

Program of Season 1922-23

The following excellent program has been arranged by the Ottawa Executive for the balance of the season's meetings.

Friday, Dec. 15—"Indicators," Dr. J. Waddell, Queen's University, Kingston.

Thursday, Jan. 11—"The Denatured Alcohol Situation in Canada," Ross E. Gilmore.

"The Detection and Determination of Wood Alcohol in the Presence of Grain Alcohol," M. M. Hale.

Thursday, Feb. 8—"Bio-Chemistry in Relation to the Rearing and Nutrition of the Silver Black Fox," G. Ennis Smith.

Thursday, Mar. 8—"Chemistry in the Canadian Civil Service," Government Chemists.

Thursday, April 12—"Electrolytic Iron," R. J. Trail.

Thursday, May 10—Annual Business Meeting, Election of Officers, etc.

Hon. Sec. A. E. MacRae,
Room 206 Langevin Block, Ottawa.

TORONTO SECTION, S.C.I. ADDRESSED BY DR. RALPH McKEE

Dr. Ralph H. McKee, professor of Scientific Research, Columbia University, New York, N.Y., was the speaker of the evening at the November meeting of the Toronto Section, Society of Chemical Industry, held at Hart House, University of Toronto, Friday evening, November 17th. There was a very large attendance of members and guests, included among the latter being several executives of the British-American Oil Company and Imperial Oil Company, and the entire fourth year class in Chemical Engineering, University of Toronto, the students being present as the guests of the British-American Oil Company.

The subject of Dr. McKee's address was "Gasoline Ten Years Hence," and as Dr. McKee is recognized as a leading authority on the "oil question," this fact, no doubt, accounted for the large attendance present. In introducing the speaker, the chairman, Mr. L. E. Westman, outlined briefly, the part Dr. McKee had played in research work in the United States. He referred particularly to Dr. McKee's work in investigations on mineral and shale oils and pulp and paper.

Summarized, Dr. McKee's address was a warning that the well petroleum supply of the United States and Mexico is fast disappearing, and that the development of the shale oil deposits of the United States and Canada was the logical and only natural field left, by which motor oil supplies could be replenished.

In commencing his address, Dr. McKee reviewed briefly the development of the petroleum industry in the United States. The industry had its birth at Titusville, Pa. in 1859, when Colonel Drake drilled the first oil well. But oil had been produced from shale deposits for a period of over twenty years before that date. The speaker had found references to oil from shale as far back as 1834, and one reference referred to an earlier one, dated 1822. These references referred to the operation as "oil from rocks."

In 1850 there were no less than some fifty plants distilling oil from shale in the United States, the shale being imported from Canada (New Brunswick), but Colonel Drake's petroleum well in Pennsylvania practically wiped out the shale oil industry overnight, but now America was beginning to look with keen interest at the enormous shale deposits of the United States and Canada, as she saw that prospects of increased supply from wells was practically nil. Production was now at its peak, and probably within three years output of wells in the United States would begin to decline. In the past, as at present, the United States furnished two-thirds of the world's production, but to-day the States were consuming more than was produced, and it was necessary therefore to import large quantities from Mexico, amounting annually to about sixty per cent. of the total Mexican production. Furthermore, the Mexican and Texas fields were of the short-lived type, and already many Mexican wells were yielding salt water instead of petroleum.

Demands for petroleum were increasing in the United States at the rate of about fifty million barrels a year, and in Canada correspondingly. To take care simply of this yearly increase in demands for petroleum it would require each year seventy-five new distilling plants, each handling 2,000 tons of oil shale per day, and representing close to an investment of one million dollars per plant. In this connection, Dr. McKee reminded his hearers that the oil shale distilling industry would require many more chemists than the present day petroleum refining industry demanded, each shale distilling plant representing an investment of one million dollars with minimum output of 1,000 barrels daily, would require from ten to fifteen chemically trained men. The speaker then described the various systems of rotating the shale, referring particularly to the industry as established in Scotland. We would refer the reader to the text of Dr. McKee's address to be given in full in our January issue. for an account of distilling methods.

Referring to the yield per ton, Dr. McKee said that there was considerable variance in yield of oil per ton of shale from different deposits. In Scotland, shales were worked which yielded only 20-22 gallons of oil per ton, but large United States deposits gave a much higher yield, the largest of these being the Green River shales of Colorado, Utah and Wyoming. He emphasized particularly, the fact that the Canadian deposits of New Brunswick and Nova Scotia were of the very best grade, and he personally believed that the Canadian deposits should be the first to be developed, then those of Kentucky. While the Canadian deposits had the advantage of nearby coal deposits for power and heat purposes, yet this fact was made up to some extent in the case of the Kentucky shales as the latter could be readily mined by steam shovels, whereas the Maritime deposits would require considerable underground mining.

The address was illustrated by some fine lantern views, both of early and recent oil shale workings. Within the past few months, the Catlin company had commenced working and distilling operations at Elko, Nevada, producing 100 barrels of oil per day.

Following the address, the meeting was thrown open for discussion. Mr. S. R. Parsons, president of the British-American Oil Company expressed his great appreciation of Dr. McKee's address. While the present oil wells in Ontario only produced enough oil to keep the Canadian Refineries operating for six days a year, yet he had faith that the Canadian west had great potential resources of crude oil. At present, Canadian refineries were largely supplied with crude oil from Mexico and South America.

Mr. C. R. Ewing, director of refining, Imperial Oil Co., said that he had been delighted with the address of Dr. McKee.

Mr. Hopkins, director of the Geological Department, of the

Imperial Oil Company, thought that more attention should be given to the development of the vast areas of bituminous sands in the Canadian west. He believed that while pumping methods had failed to successfully remove these sands, there would seem to be no reason why similar methods to those used in working oil shale deposits would not be successful, namely by steam shovel. He believed that there were good possibilities for obtaining large resources of crude petroleum from wells in the Canadian north-west, and even along the American boundary. Mr. W. A. Schorman, director of refining, British-American Oil Company, believed that the address of Dr. McKee had opened up a broader field of great interest, and he personally had been more than pleased to hear the subject so ably presented.

Dr. Lash Millar enquired of the speaker, what the probable price of gasoline would be, when produced from shale oil. In reply, Dr. McKee thought that taking everything into account, a price of something like forty cents per gallon for motor oil would probably prevail.

GOVERNMENT POSITION OPEN

The Civil Service Commission, Ottawa, has been considering applications for the position of Chief Chemist in the Department of Public Health. This department employs a very considerable number of chemists in connection with food and drug inspection work. Laboratories exist at Halifax, Montreal, Ottawa, Winnipeg and Vancouver. The initial salary going with this post is $4,800 per annum, going to $5,100 at the end of one year, which is an indication that the Dominion Government seems prepared to secure and hold the best available men in its employ. The duties of the position call for considerable executive ability and a fundamental knowledge of the chemistry of foods and drugs, as well as legal standards governing the same. One of the requirements for the position is an experience of at least ten years in analytical and research work in this connection. The position is made vacant by the retirement of Dr. A. McGill.

POSITIONS OPEN IN CIVIL SERVICE

The Civil Service Commission, Ottawa, announces open competitive examinations for the following positions:

4729—Dominion Agricultural Bacteriologist, Experimental Farms Branch, Department of Agriculture, Ottawa, at an initial salary of $2,880 per annum, with allowance of house, or $30 per month in lieu thereof. For efficient services this salary will be increased at the rate of $120 per annum until a maximum of $3,360 has been reached.

DUTIES—To be responsible for work of Division of Bacteriology, Experimental Farms, under the Director of Experimental Farms, research work, organizing protective and control methods against destructive bacteria, preparation of reports, supervision of laboratory, etc.

QUALIFICATIONS—Graduate in science from college of recognized standing with specialization and post-graduate course in bacteriology.

4730—Dominion Cerealist, Experimental Farms Branch, Department of Agriculture, Ottawa, at an initial salary of $2,880 per annum, house or allowance of $30 per month to be increased for efficient services at rate of $120 per year until a maximum of $3,360 has been reached.

DUTIES—To be responsible under Director of Experimental Farms for work of Cereal Division, production of improved strains of cereals and new varieties of cereals, conducting tests on cereals, preparation of reports and supervision of distribution of cereals, etc.

QUALIFICATIONS—Education equivalent to graduation in agriculture from a college of recognized standing, with specialization in agronomy, and post-graduate experience in directing experimental and research work relating to cereals, etc.

EXAMINATION—For both the above positions, a rating on education and experience will be given from the sworn statements submitted by applicants on their application form. To those who qualify an oral examination may be given if necessary.

4731—Assistant Chemist for the Foods and Drugs Division, Department of Health, Ottawa. Initial salary $2,100 per annum, to be increased for efficient services at rate of $120 per annum until a maximum of $2,580 has been reached.

DUTIES—Chemical analyses and physical examination of substances, analysing foodstuffs and drugs, and other related work under supervision.

QUALIFICATIONS—Education equivalent to graduation from a university of recognized standing, with special training in analytical chemistry, preferably one year of laboratory experience

EXAMINATION—Rating on education and experience from the sworn statements submitted by applicants on application forms.

There are at present two vacancies. An eligible list may be established from which future vacancies may be filled.

Special preference for all positions given first to candidates on pension from disability as a result of war service, and who have not been successfully re-established, and secondly, to candidates who have been on active service overseas.

Application forms must be filed at office of Civil Service Commission, Ottawa, NOT LATER THAN DECEMBER 14. Forms may be obtained from offices of the Employment Service of Canada or from the Secretary of the Commission, W. Foran, Ottawa.

In addition to the above positions, two Assistant Chemists are required for the Food and Drugs Division of the Department of Health, at an initial salary of $2,100 per annum, with annual increase of $120 until a maximum of $2,580 is reached. University degree in chemistry required. Applications must be filed on usual forms, not later than December 21st, 1922. Apply Civil Service Commission, Ottawa.

S. P. S. RE-UNION

The University of Toronto in all departments is maintaining the interest of alumni. No faculty, however, can rival that of Applied Science in maintaining a "School Spirit." The Engineers, returned on October 27th and 28th, to celebrate a grand re-union. Annually, we understand, will this great occasion be repeated. Friday evening saw festivities under way, with a dinner dance at the King Edward Hotel. Saturday morning, year meetings were held with representatives present from the eighties down. The Faculty of Applied Science gave a reception, following the Queen's-Varsity rugby game, and the Annual Dinner in Convocation Hall completed the program. Along with a lot of fun, songs and noise, a few speeches were put over. Capt. C. E. MacDonald proposed the toast of the University of Toronto. Prof. A. T. DeLury, of great fame among all graduates, but more particularly University College, went back so far in his experiences during his reply that even the most venerable "school" man was almost persuaded that he was listening to one of his ancestors. Dr. A. c. Humphreys, president of the Stevens Institute of Technology, Hoboken, N.J., replied to the toast to the Engineering Profession, stressing the necessity of preparing students in all complete essentials before allowing graduation. Prof. H. E. T. Haultain proposed the silent toast, which was followed by "The School," by W. E. Douglas of '02, and replied to by Dean Mitchell of the class of '92. Dean Mitchell made an appeal for scholarships. The Faculty of Applied Science has had a phenomenal growth at the University of Toronto, and now has an army of graduates constituting an active alumni, which are out to maintain and build up the strength and influence of the Faculty.

"CHEMICALS AND ALLIED PRODUCTS, 1919 and 1920"

This report recently issued by the Dominion Bureau of Statistics, Ottawa, is, as stated in the preface, the result of the first comprehensive survey of the production of chemicals and allied products in Canada, and was prepared under the direction of Mr. S. J. Cook, F.C.I.C., chief of the Mining, Metallurgical and Chemical Branch of the Bureau, by Mr. H. C. Barlow, B.A. The report is a decided credit to the Bureau and reflects on every page the great advantage and wisdom in having a technically trained staff engaged in supervising the production of reports covering chemically controlled industries. Although the report covers 1919 and 1920 in detail, tables are included giving exports and imports from 1895 to March 31st, 1922.

Production has been dealt with in the report under ten groups, namely: Coal tar and its products; Acids, alkalies, salts and compressed gases; Explosives, ammunition, fireworks and matches; Fertilizers; Medicinal and pharmaceutical preparations; Paints, pigments and varnishes; Soap, perfumery, cosmetics and toilet preparations; Inks, dyes and colors; Wood distillates and extracts; Miscellaneous chemical industries.

The industries included in the above groups for the year 1921, comprised 444 plants, employed 12,289 hands, paid out in wages and salaries, $15,853,000, paid out for materials used in production, $36,203,000, produced goods valued at $77,748,000, with a total capital investment of $109,225,000. In value of production, paints, pigments and varnishes came first, both in 1920 and 1921, soaps and perfumery second, with medicinal and pharmaceutical preparations third in 1921. In 1920, acids, alkalies and compressed gases ranked third.

As pointed out in the introduction and summary of the report the trend in imports and exports of chemicals and allied products showed a gradual but steady increase in value during the past twenty years. The earliest figures presently available are those for 1895, when a total of $3,469,200 worth was imported, made up of $1,174,408 from the United Kingdom, $1,614,921 from the United States and $679,871 from all other countries. The first figures now available for exports of chemicals and allied products date back to 1892, when a total of $760,800 was reached. Of this, nearly $600,000 worth went to the United Kingdom and about $100,000 worth to the United States.

Tables are given showing the values of these imports by countries of origin and of the exports by countries of destination from the first year for which data are available down to date.

Summary statistics are presented in tabular form, and the table forming the frontispiece to the report shows the principal data regarding these industries for the years 1919-20-21. This table is produced in connection with this review for the benefit of those interested. Following this summary table and the tables of imports and exports referred to, there follows nine general tables covering each year 1919 and 1920 or eighteen tables in all, giving a broad general survey both of the industrial groups in the series and of the provincial distribution for each section covered such as capital, labor, wages, cost of materials, value of products, etc.

There follows these, ten chapters covering in detail each of the groups under review. Every student of economic developments, business men seeking new avenues of investment, and particularly members of the graduating classes in chemistry and engineering of our universities—would find their time amply repaid by reading and studying these chapters. Too many of our university men have but a faint idea of the business statistics, production and labor costs of the industries in which they hope to secure employment and this report presents such information in concise and readable form.

A splendid feature of each chapter is the fact that the text matter is not burdened with statistical matter that rightly belongs to the tables where such data may be studied at leisure. The aim throughout has been to compile the information in a way that would be easily read, and for this reason, little mention has been made in the text of such data as may more readily be found in the tables.

The report presents tangible proof of what many believed to be true, but which not a few doubted, namely, that the production of chemicals and allied products is established on a firm basis in Canada; that the chemical industry is not a "war baby," though albeit it received considerable impetus under the necessity for war supplies, but is, rather, a strong and healthy youth with every promise of becoming a very important factor in Canada's industrial and commercial world.

SUMMARY STATISTICS

Chemicals and Allied Products in Canada for the Years 1919, 1920, 1921

Year	No. of Plants	Capital	Employees	Salaries and Wages	Cost of Materials	Selling Value of Products
Coal Tar and Its Products						
		$		$	$	$
1919	11	1,099,000	128	146,000	353,000	847,000
1920	11	1,385,000	160	217,000	615,000	2,035,000
1921	10	1,007,000	107	139,000	248,000	863,000
Acids, Alkalies, Salts and Compressed Gases						
1919	43	26,556,000	2,700	3,550,000	3,753,000	13,540,000
1920	50	32,473,000	3,479	5,444,000	4,813,000	18,729,000
1921	49	31,470,000	1,825	2,943,000	2,757,000	10,749,000
Explosives, Ammunition, Fireworks and Matches						
1919	18	20,198,000	2,815	2,387,000	4,720,000	10,631,000
1920	21	14,690,000	2,631	2,858,000	5,772,000	12,703,000
1921	19	13,094,000	1,487	1,819,000	3,926,000	8,664,000
Fertilizers						
1919	15	3,546,000	367	354,000	1,461,000	2,541,000
1920	16	3,840,000	402	437,000	2,839,000	3,788,000
1921	15	3,347,000	321	353,000	1,936,000	3,104,000
Medicinal and Pharmaceutical Preparations						
1919	97	11,828,000	2,776	2,594,000	5,854,000	13,740,000
1920	100	12,191,000	2,838	2,965,000	7,030,000	15,728,000
1921	98	11,940,000	2,153	2,576,000	5,582,000	12,545,000
Paints, Pigments and Varnishes						
1919	46	17,852,000	2,234	2,525,000	10,937,000	19,523,000
1920	48	20,321,000	2,568	3,431,000	15,919,000	26,939,000
1921	48	18,628,000	2,203	3,108,000	7,959,000	15,143,000
Soap, Perfumery, Cosmetics and Toilet Preparations						
1919	55	12,949,000	1,830	1,789,000	12,641,000	18,858,000
1920	58	16,239,000	1,996	2,267,000	12,925,000	19,805,000
1921	58	14,829,000	1,942	2,088,000	7,652,000	13,614,000
Inks, Dyes and Colors						
1919	24	1,550,000	331	419,000	1,151,000	2,362,000
1920	25	1,932,000	412	613,000	1,644,000	3,289,000
1921	23	1,713,000	335	579,000	961,000	2,372,000
Wood Distillates and Extracts						
1919	17	6,005,000	485	432,000	1,718,000	2,998,000
1920	17	4,247,000	605	701,000	2,156,000	4,982,000
1921	13	2,756,000	354	341,000	1,014,000	2,148,000
Miscellaneous Chemical Industries						
1919	103	10,179,000	1,937	2,187,000	5,705,000	11,424,000
1920	110	11,524,000	2,192	2,802,000	6,810,000	13,688,000
1921	111	10,441,000	1,562	1,907,000	4,168,000	8,546,000
All Industries						
1919	429	111,760,000	15,603	16,384,000	48,294,000	96,464,000
1920	456	118,841,000	17,283	21,736,000	60,069,000	121,687,000
1921	444	109,225,000	12,289	15,853,000	36,203,000	77,748,000

Mining and Metallurgy in British Columbia

(Special Correspondence to Canadian Chemistry and Metallurgy.)

Granby and Consolidated Advance Wages

Owing to the shortage of labor, the two smelting companies have been obliged to increase their wage-scales, despite the fact that neither company has paid a dividend to its shareholders for more than two years. The Granby Consolidated Mining, Smelting & Power Company has abolished its sliding scale, based on the market price of copper, and has given its employees a straight fifty-cent raise all round. The wage-scale now in force at the Anyox smelter and Hidden Creek mine is: Miners, $4.75; muckers, $4.25; metal craftsmen and carpenters, $5.50; outside laborers, $3.60, and stevedores, $4.00. The Consolidated Mining & Smelting Company of Canada has arranged to give its miners and smeltermen a monthly bonus based on London lead and zinc prices. The following is taken from a circular issued by the company: "The average price will be arrived at by taking three-fifths of the average London price of lead, and two-fifths of the average London price of zinc each calendar month. This is approximately the proportion of our production of lead and zinc from our ores. The wages for each month will be based on the price for the month preceding. The bonus for October will be twenty-five cents per man per shift. We are obliged to use London prices, rather than the United States, because that country has established a barrier-tariff, which shuts us out from its markets. Besides, most of our product is exported to countries where London prices are the basis of competition. In fact, Canadian prices are fixed by the London Metal Exchange."

Portland Canal Division

The Granby company has further increased its holdings in the Portland Canal division by bonding the Outsider group, situated on the Portland Canal, thirty-five miles south of Stewart, and the Sunshine group, on Glacier Creek, about nine miles north of Stewart. Camps are being established at both properties, and contracts for development work have been let. The work will be continued through the winter, and until the values of the properties have been demonstrated. The Outsider group was located in 1903 and sold to the Brown-Alaska Company in 1905. This company shipped 14,500 tons of ore to the Hadley smelter, on Prince of Wales Island, Alaska. The property changed hands once or twice after this, but nothing of importance was done until 1917, when new interests spent some $35,000 in development, and demonstrated the existence of ore at 400 feet below the outcrop. The option on the property was allowed to lapse, and now the Granby company will test the property thoroughly. The winter's work will consist of putting up a raise of 200 feet and continuing the tunnel. At the Sunshine group the work during the winter will consist of tunnelling. Several lodes have been uncovered on the surface, and two tons of high-grade ore, which was sent to the Tacoma smelter this summer, brought a return of $221 per ton in silver and copper. Next summer it is likely that both properties will be explored by diamond drills.

A number of other properties have changed hands within the last few weeks. Seattle interests being particularly active. J. Reinhert, of Seattle, has bonded the Sunrise group, at the head of Salmon River glacier. R. J. Reebe and associates, of Seattle have bonded the Silver Bell group, at the mouth of the Bear River, and have commenced development work, which will be continued through the winter. A Seattle syndicate has bonded the Silver Cross group of eleven claims, situated at the head of Salmon River glacier.

Kootenay Division

Silversmith Mines, Ltd., disbursed its usual quarterly dividend amounting to $25,000, on October 1, for the quarter ended September 30. The ore-shoot on the Ruth vein has been re-located recently, and is yielding five inches of clean silver-lead ore. The mine is outputting about 100 tons of crude high-grade silver-lead ore, 400 tons of silver-lead concentrate, and 300 tons of silver-zinc concentrate monthly.

The Spokane Mining Company, which has been operating the California and Athabasca mines, near Nelson, under lease and bond for some time, has relinquished its option, after spending some $175,000 in development and equipment. A large amount of ore averaging $16 in gold per ton has been blocked out, but the difficulty has been that the ore is very refractory, and only a low extraction has been made in the mill. It was thought that the mill would be altered to overcome this, but, after experimenting for a time, the property has been abandoned.

Wilfred Cameron, who is operating the Molly Gibson under lease, has 100 tons of high-grade ore ready for shipping, as soon as road conditions have been sufficiently improved to allow motor trucks to operate between the railway terminus and the lake, at Kitto Landing.

Development work at the Ruth and Hope mines, in the Slocan, has opened up a new ore-body, and as soon as working spaces allow the force of men is to be largely increased. These mines were taken over recently by a Vancouver syndicate, headed by R. H. Stewart, formerly manager for the Consolidated M. & S. Co.

Ten cars of silver-lead concentrate recently were shipped from the old dumps at the Noble Five mine. This mine has been closed since the death of its owner, James Dunsmuir, more than a year ago. The mill was started recently, however, to clean up the concentrate prior to shipping. Dunsmuir bought the property, in 1919, for $250,000, and erected a modern mill, which is one of the largest and best equipped mills in the Slocan.

Important Sales

The most important mining transaction that has happened in the Province since the sale of a three-fifths interest in the Premier mine to New York capitalists is the bonding of the Le Roi No. 2 mine, at Rossland, to New York and Spokane interests. The deal was engineered by Douglas Lay, manager of the mine, and Messrs. Tate and Daly, of Spokane, and, though the consideration and terms have not been officially announced, the purchase price is rumored to be a million and a half. The sale of this property practically closes out the one-time extensive London holdings in British Columbia mining properties. Le Roi No. 2 has been, and is, an excellent property, and it has paid some good dividends to its English shareholders. Since the slump in the price of copper, in the fall of 1921, operations have been confined to picking over and concentrating some of the old waste dumps, and this has proved a profitable occupation, nature having materially assisted in the concentrating operation by oxidizing a good deal of the pyrrhotite without materially altering the chalcopyrite which contains the gold.

Negotiations are being made for the purchase of other Rossland properties. The Consolidated M. & S. Co. has sampled the Apex, and Clarence Cunningham, the well-known Slocan operator, has made an examination of the Velvet mine.

Subject to ratification by the shareholders, H. H. Armstead, a successful operator of mines in the States of Idaho and Washington, has purchased the whole of the stock of Utica Mines, Ltd. For several years the Utica mine has been operated under lease, and some of the lessees have made excellent profits. Recently O. C. Thompson has had a lease of the property, and has driven a long tunnel, for the purpose of cutting the ore-body at depth. Some of the richest silver ore ever found in the Slocan has come from this mine.

The Slocan Consolidated Silver Mines, Ltd., has purchased the Wellington group, at Retallack. The Slocan Consolidated has had the property under bond and lease for some time.

Galena Farm mine, near Silverton, has been bonded to Roy F. Ainslie, of Syracuse, New York State, for $60,000, payable over a period of three years. The mine is equipped with a concentrator and has been a fair producer. It has changed hands twice in recent years at $1,00,000.

Greater Activity in Mining

It will be seen from the foregoing that there is far greater activity in mining in British Columbia than there has been for many years, and United States capital is flowing freely into the Province for the development and equipment of mines. Prospectors have put in a very busy summer, and there have been really important new discoveries in all parts of the Province, space limitations, however, prevent details being included in this article. There was a three-day meeting of the western branch of the Canadian Mining Institute at Vancouver, commencing November 15, and a really excellent programme was provided. A number of valuable papers were presented, and moving pictures of the Quebec asbestos industry, the Ontario gold mining industry, and the operations at the Trail smelter were shown. On the third day there was a trip to Nanaimo and some of the important collieries in the neighborhood were be visited.

WORLD CONDITIONS AND NEWS IN CHEMICAL FIELDS

GREAT BRITAIN

English Chemical Market

The trade in heavy chemicals continues in fair demand, with an unexpected improvement in fine chemicals. Among products in reasonably heavy demand are: ammonia, alkali, bleaching powder, chlorine products, caustic soda, chloride of calcium, acetic acid, acetone, arsenic and tar products.

Textiles

Textile industries have been working full time, but the opinion that lower prices will be available restricts the production to present needs. British materials are regaining their hold in markets where there is no restriction on importation.

Iron and Steel

British manufacturers are getting the largest share of international orders for iron and steel; but it is covering less than fifty per cent. of its capacity. The cause for the small volume of business is not competition, but taxes and exchange. Foreign and colonial orders, however, are expected to be placed shortly.

Iron and Steel Syndicate

The steel syndicate mentioned before in these columns is expected. The French see keen competition with German and British industries in the future. An understanding between France and Germany regarding Lorraine ore and German fuel is desired. French manufacturers fear that the lack of coal will bring an advance of British fuel prices, as the industries regain their normal position. Germany, too, believes they could obtain Lorraine and French ores cheaper than they can now obtain ores from Spain or Scandinavia.

British Cellulose Company

The present capacity of the British Cellulose Company plant is one ton a day, but the increase in the size of the orders and the number received is forcing the plant to obtain a capacity of three tons a day. Specializing on artificial silk has improved the Company's standing considerably. Fabrique de Soie Artificielle de Tubize will buy acetate of cellulose for artificial silk manufacture, and Clauel and Lindenmeyer, the first dyers to treat the British Cellulose product successfully, are enlarging their plant at Basle, Switzerland.

Part I. of New Color Index

The Society of Dyers and Colorists, of Bradford, have issued the first part of their Color Index, which will meet the requirements of color manufacturers, color users, or student of color chemistry.

Glass Trade

The glass trade, though very much below normal, is showing a slight improvement. The home producer is now competing more successfully than before in foreign markets, owing to recent reductions in price, which bring them nearer the level of competitors. The home market, however, is still dominated by cheaper foreign wares.

Steel and Cast Iron Substitute

Cellactite, a substitute for steel and cast iron pipes, has remarkable strength, and will not warp or sag in the sun. It is in the highest degree corrosion-proof, and its expansion and contraction are practically nil. It is manufactured from asbestos and other fibrous materials, with a non-oxidizing bituminous compound.

Research for Metals Industry

The British Non-Ferrous Metals Research Association which has received encouraging support by leading firms, has recently issued a pamphlet, "Research Work in Progress." It covers investigations in copper, brass, aluminium, nickel and lead industries.

The Bureau of Information of the Association is distributing to members reports of the results of the experimental researches, and otherwise collecting and distributing valuable information to the industry.

NITRATE COMMITTEE APPOINTS CANADIAN REPRESENTATIVE

B. Leslie Emslie has been appointed manager of publicity for the Chilean Nitrate Committee for Canada, with offices at the Royal Bank Bldg., Toronto. He has had a very wide experience in soil fertility and fertilizer work. He was born on a Scotch farm and graduated from the West of Scotland Agricultural College, Glasgow. Following this, he spent a few years in Canada, but returned to Europe in 1904 and became associated with the German Potash Syndicate at Strassfort. Here he assumed direct supervision of fertilizer experiments on fruit trees and vegetables. He also assisted in potash propaganda in English-speaking countries and the far East. Later, he took complete charge of the educational work along this line in Canada. Subsequently, he entered the employ of the Dominion Government, lecturing through the country on the use of fertilizers, and for the past seven years was associated with Dr. Shutt of the Experimental Farm, Ottawa, as a soil fertility specialist. During this period, he contributed largely to farm and daily papers and issued a number of special reports and Government Bulletins.

INDUSTRIAL DEVELOPMENTS

Toronto, Ont.—The British American Oil Company, Ltd., are enlarging their refinery by the erection of a new process building. The very latest equipment is being installed for the making of certain lubricating oils. Recently the company have established six new branches in Ontario and Quebec, each with large tank storage and warehouse accommodation.

Huntingdon, Que.—The Condensed Milk plant, formerly operated by the Borden Company has been purchased by the Baumert Company, Canadian branch of F. X. Baumert and Company, Antwerp and New York, who will specialize in the manufacture of fancy cheeses and butter. Mr. Owen S. Pickard will be in charge of production.

Oshawa, Que.—The Ontario Potteries, Limited, have purchased a large garage building on 3½ acres of land, and are making suitable alterations, and installing equipment for the production of semi-vitreous tableware, hotel and restaurant equipment, etc. They are also making a large extension to the present building. Equipment being installed includes 72 chamber filter press, agitators, jiggers, lathes, etc. At present two pottery kilns are being installed and five more will be added early next year.

Kingston, Ont.—Stanley & Aylward, Ltd., silver plate makers, who recently moved here from Toronto, are well established in their new plant, employing thirty men. The company's new product "Norman plate" is made completely in the new plant.

Whitby, Ont.—The Whitby Brick & Clay Products Co., under the management of W. Baines, are building kilns, giving a production of 50 tons per day.

Georgetown, Ont.—Smith & Stone, Ltd., have been granted a loan of $40,000 by a by-law carried by ratepayers, for the erection of kilns for the manufacture of porcelain insulators.

North Bay, Ont.—The Red Wing Quarry Co., Ltd., capitalized at $500,000, will erect a large stone crushing plant here for the preparation of building material, having acquired several deposits of different varieties of rock.

Hamilton, Ont.—The Canadian By-Products Co., Ltd., capitalized at $600,000 will erect a plant here for the manufacture of brick, tile, terra cotta, sewer pipe, etc.

Winnipeg, Man.—The Consumers Co., Ltd., will erect an artificial ice plant and warehouse at Ross Ave. and Tecumseh St., at an ultimate cost of $300,000, with initial outlay of $30,000.

Montreal—The Sherwin-Williams Co., paint makers, are increasing operations, and output. Their fiscal year ended August 31st last, showed increase of 20% in gallonage and tonnage.

Montague, P.E.I.—The addition of embalming fluids and disinfectants to the products of the Montague Furnishing Co., Ltd., has necessitated the installation of a laboratory.

Montreal, Que.—The Dougall Varnish Co. have recently enlarged their plant and installed new machinery. Their operations and output are increasing.

Winnipeg, Man.—Operations have increased steadily during the past three months at the plant of the Manitoba Bridge & Iron Works, Limited.

The Manitoba Rolling Mills Co., Ltd. are operating their open-hearth furnace to capacity, turning out about fifty tons of new steel per day.

Toronto, Ont.—Pressed Compositions, Limited, located at 108 River Street, are progressing with their manufacture of hard rubber substitutes, such as phonograph records for the Aeolian Company, electrical insulators, etc. G. E. Lindsay is president, and W. E. Radcliffe, managing-director.

Sherbrooke, Que.—The Dominion Lime Co., Ltd. are planning for the erection of a modern hydrating plant at their works at Lime Ridge, Que. The Lime Ridge plant has ten kilns and a ground limestone plant of capacity of from 200 to 250 tons per day; products are: high calcium lump lime for chemical and other industrial uses, finely pulverized limestone for agricultural purposes.

NORTHERN ONTARIO MINING NOTES

Kirkland Lake District

The newly formed Osweka Gold Mines Company, capitalization $3,000,000, has taken over the Kreisler claims.

Repairs have been completed on K. L. transmission lines.

Discovery of easterly continuation of fractured zone during surface trenching, of which the Continental has completed 17,000 feet, is reported.

Continental Mines have now shaft down 400 feet with their objective 900 feet, and a possibility of over twice the distance.

Hudson Bay Mines report revenue for the year ending August, 1922, $12,163, expenditures $19,739. The company has good stock in Consolidated West Dome Lake Mines and also in Dome Lake Mines, both of which are on a firmer basis.

Porcupine District

Samples of Clifton ore taken from the 235 foot level are valued at several hundred dollars a ton. Rich specimens are reported the 100-foot level. The particularly rich section of the vein has a width of two feet. A substantial tonnage of high grade ore is awaiting treatment by the new milling plant.

The mill has in operation a temporary steam plant while awaiting power from the Northern Canada Power Company. The mill bins are filled with ore, expected to average $20.00 per ton.

The McIntyre Porcupine Mines have found rich ore at 2,125 feet, believed to be a continuation of No. 6 feet, lost some years ago at a point several hundred feet nearer the surface. It is the lowest Porcupine level yet reached.

The Blue Quartz Gold Mines Limited encountered a vein on the 200 foot level, valued at $9.20 to $53.60 per ton. A winze will be sunk from the 200-foot level on the vein and a large hoist is on order for installation.

The Hollinger Mine stands fourth among the leaders of Canada's profit making concerns. The net profits of the company after fixed charges and depreciation have been met, show $4,026,000. The Dome Mines stands fifteenth with $1,244,000.

Nipissing District

The Nipissing Mining Company closed down for a week, many employees being burnt out in the Haileybury fire. During October, $151,665 worth of ore was mined, and bullion valued at $228,579 shipped. The month's silver was valued at 66¾ cents per ounce. 32,000 lbs. cobalt were produced, and 201,690 fine ounces of silver were shipped.

Nine gold claims have been recently staked in the Goudreau district township 47. The Goudreau Mine is about to build a mill on its property.

Kerr Lake District

Lateral work on the 500-foot level of the deepened shaft of the Goldale Mines, is proceeding at the rate of 100 feet a week. At a 200-foot level, a vein was struck which showed good milling ore. In the lateral work on the 500-foot level, four schisted sections in granular basalt were encountered while in No. 503, quartz and iron sulphides in grey basaltic schist were struck. At a point 150 feet north from the east drift of No. 503, the lower extension of a quartz porphyry tongue was encountered, and a short distance from this point a five-foot quartz vein in the prophyry carrying good values was encountered.

No. 501 cross cut off the east drift has exposed favorable mineralization, the quartz free from gold encountered assaying from $4.00 to $12.00 in gold. The cross cuts were driven for geological information and the work of drifting to the east is now proceeding in order to expose the lower extensions of the more favorable mineralized section indicated by the diamond drilling done east of the shaft in 1921 when good values were obtained in the drill cores.

Keystone District

A campaign of diamond drilling may be inaugurated on the 200-acre Keystone claims where trenching, stripping and other developments have been progressing recently.

BRITISH COLUMBIA INDUSTRIAL NEWS

The Ferphos Fish Products Company, Limited, has been formed, with head office in Victoria, for the purpose of taking over the patents of E. G. Henshall and building a factory at Skidegate Inlet, Queen Charlotte Islands, in which oil will be made from dogfish, under the said patents. Skidegate Inlet has been selected as a site for the factory, because dogfish of an unusually large size—weighing 10 to 40 pounds—are very plentiful in the waters of the district.

For some time, Mr. Henshall has been operating a smal experimental plant at Sooke, twenty miles from Victoria, where he claims to have demonstrated that by his process the whole of the fish is used, and 100 per cent. more oil is extracted than by methods hitherto in use on the coast. Further, it is claimed, a better grade of oil is produced. By the old method, oil was extracted only from the liver of the fish, and except in a few instances where the fish was used to fertilize nearby soils the rest of it was wasted. By the old method, five tons of fish yielded on an average 100 gallons of oil, whereas by the Henshall process five tons of fish is said to yield 200 gallons of oil and 2,000 pounds of fish-meal. The local paint manufacturers have taken all the oil produced in the experimental plant, and have pronounced it to be of a high grade, while the fish-meal, which is intended as feed for poultry and swine, has been tried and endorsed by the Provincial poultry inspector. The plant will have a capacity of fifty tons of fish per day, and will be managed by Mr. Henshall. S. T. Hankey, of Victoria, will have the business management of the concern.

An English syndicate has purchased B. C. distilleries from W. Braid, who has operated them for the last eighteen years. The distillery is situated at New Westminster. The purchase price has not been announced, though a considerable sum is said to have been given for the property and goodwill, nor has any information as to the intention of the new owner been given out.

NEW TECHNICAL SCHOOL AT THE "SOO"

One of the finest technical schools in Ontario was officially opened at Sault Ste. Marie, Ont., November 9th. Over a thousand citizens turned out to witness the opening formalities at which Dr. F. W. Merchant, director of technical education for Ontario was the chief speaker. Dr. Merchant declared that the extent to which the natural resources of the country were developed depended upon the extent to which the youth were properly educated.

SMART TURNER REPORT INCREASED SALES OF PUMPS

The Smart Turner Machine Co., Hamilton, Ont., report considerable activity in their pump department, and have recently received order for the following:—

2—No. 4 double suction centrifugal pumps, for The Abso-Pure Ice Co., Hamilton.
10—Small triplex power pumps, for Dominion Lighthouse Depot at Prescott, for Dept. of Marine and Fisheries.
1—No. 4 belt-driven centrifugal, H. F. Routley Quarry, at Caledonia.
1—4½ x 2¾ x 4 duplex packed piston pump, for the Standard Paving Co., Lindsay.
2—8 x 10 x 12 Simplex Vacuum Pump.
1—Automatic Feed Pump and receiver equipment, with motor-driven centrifugal pump.
2—Motor driven centrifugal pumps, for Essondale Asylum, Vancouver, B.C.
1—5½ x6 Triplex Power Pump, for Vipond-North-Thomson Mines, Timmins, Ont.

MARKETS

Owing to lack of space we are unable to include our usual Market Review in this issue. On pages 277 and 278, however, the latest quotations are given.

CANADIAN PRICES QUOTED BY MANUFACTURERS OR WHOLESALERS.

General Chemicals and Industrial Minerals.

Inorganic.

Alum, Ammonia, lump or ground	100 Lbs.	4.50— 5.00
Ammonium Bromide	Lb.	.. — .22
Aluminum Sulphate, lump, bags	Cwt.	2.25— 2.50
Aluminum Sulphate, ground, bags	Cwt.	2.50 2.75
Aluminium Sulphate, iron free	Cwt.	.. — 4.00
Ammonia, Aqua, 26, Carboys	Lb.	.. — .12
Ammonia, Aqua, 26, Drums	Lb.	.. —.09½
Ammonium Carbonate	Lb.	.12— .15
Ammonium Chloride	Lb.	.08— .11
Ammonia Iodide	Lb.	.. — 6.25
Arsenic	Lb	.10— .12
Barium Sulphate (Barytes)	Pre Ton	30.00—35.00
Barium Chloride	Lb.	.05— .07
Barium Nitrate	Lb.	.. — .16
Barium Peroxide	Lb	.. — .21
Barium Sulphate, B.P.	Per Ton	60.00—60.00
Battery Acid, up to and including 1.400 sp. gr.	Cwt.	3.00— 3.50
Battery Acid, over 1.400, up to and including 1.835 sp. gr.	Cwt.	3.50— 4.00
Bleaching Powder, 35% drums	Lb.	2.50— 3.00
Borax, crystals	Lb.	.07—.07¼
Boric Acid	Lb.	.. — .13
Bromine (technical)	Lb.	.. — .38
Calcium Acid Phosphate	Lb.	.. —.07½
Calcium Carbide, ton lots, f.o.b. works	Ton	.. —95.00
Calcium Carbide, less than ton lots, f.o.b. works	Ton	..—100.00
Calcium Chloride, fused	Per Ton	.. —25.00
Calcium Chloride, flake	Ton	40.00—42.00
Caustic Soda, ground, drum	Cwt.	5.00— 5.50
Caustic Soda, solid, drum	Cwt.	4.25— 4.75
Camphor Monobromate	Lb	.. — 3.00
Carbon Bisulphide, in drums	Lb.	.11— .12
Carbon Tetrachloride, drums	Lb.	.. — .15
Chalk, Precipitated	Lb.	.04¼— .06
China Clay, Canadian, f.o.b. Huberdeau, Que., car lots	Ton	17.00—18.00
China Clay, imported	Per Ton	20.00—25.00
Cobalt Oxide, black	Lb.	.. — 2.00
Cobalt Oxide, grey	Lb	.. — 2.25
Copperas (Iron Sulphate) crystals	Lb.	.02—.02¼
Copperas (Iron Sulphate) sugar	Lb.	.02—.02¼
Copper Sulphate (Blue Vitriol)	Lb.	.08—.08¾
Corrosive Sublimate (Mercuric Chloride)	Lb.	.. — 1.10
Fluorspar, ground	Tons	.. —30.00
Fuller's Earth, powdered	100 Lbs.	2.00— 2.50
Fuller's Earth, car lots, f.o.b. Toronto	Ton	.. —30.00
Ferric Chloride, crystals	Lb.	.11— .12
Ferric Chloride, solution	Lb.	.. — .10
Hydrofluoric Acid, 60%	Lb.	.25— .28
Hydrofluoric Acid, 30%	Lb.	.12— .14
Hydrochloric Acid, carboys, 18	100 Lbs.	2.25— 2.75
Hydrogen Peroxide	Gal.	.70— .75
Iodine, crude	Lb.	.. — 4.50
Iodine, resublimed	Lb.	.. — 5.25
Iron Oxide (red)	Lb	.05— .13
Lead Acetate	Lb.	.14— .16
Lead Nitrate	Lb.	.14 — .15
Lime, grey	Ton	.. —14.30
Lime, grey, in car lots	Ton	.. —11.70
Lime (hydrated) in ton lots	Ton	.. —20.00
Litharge	Lb.	.09— .10
Lithium Carbonate	Lb.	1.75— 2.10
Lithopone	Lb.	.08— .09
Magnesite, calcined	Per Ton	.. —30.00
Magnesite, clinkered	Per Ton	.. —35.00
Magnesite, raw	Per Ton	.. —10.00
Magnesium Carbonate, bbl	Lb.	.12— .13
Magnesium Sulphate	Lb.	.03½—.04½
Mag. Sulphate, B.P., Medicinal	Single Ton	60.00—70.00
Mag. Sulphate, Technical, car lots	Ton	45.00—50.00
Mica, ground, f.o.b. Hull, Que.	Ton	.. —60.00
Muriatic Acid, 18	100 Lbs.	2.25— 2.75
Nickel Salt, single, in bbl. lots	Lb.	.. — .15
Nickel Salt, single, per cwt.	Lb.	.. —.16½
Nickel Salt, double, barrel lots	Lb	.. — .15
Nickel Salt, double, per cwt.	Lb.	.. —.16½
Nitric Acid, 36 carboys	100 Lbs.	8.75— 9.00
Phosphoric Acid, 85%	Lb.	.. — .28
Phosphoric Acid, 50%	Lb.	.. — .22
Phosphorus, yellow	Lb.	.. — .34
Potash Prussiate, yellow	Lb.	.28— .30
Potassium Bicarbonate	Lb.	.. — .20
Potassium Bromide, crystals	Lb.	.22— .30
Potassium Bromide, granular	Lb.	.22— .30
Potassium Bichromate	Lb.	.17— .18
Potassium Carbonate, calc. 80%-85%	Lb.	.. — .09
Potassium Chlorate	Lb.	.. — .10
Potassium Citrate	Lb.	.. — 2.50
Potassium Hydroxide (Caustic Potash)	Sticks	.. — .45
Potassium Hydroxide (caustic potash) small drums	Lb.	.10— .15
Potassium Hydroxide (caustic potash) large drums	Lb.	.07— .08
Potassium Iodide	Lb	.. — 4.20
Potassium Nitrate, casks	Lb.	.10— .12
Potassium Permanganate, bulk	Lb.	.19— .20
Red Precipitate (Mercuric Oxide)	Lb.	.. — 1.50
Silver Nitrate	Lb.	.. — 9.00
Soda Ash, bags	Cwt.	2.25— 2.40
Sodium Acetate, ton lots or over	Lb.	.. — .08
Sodium Acetate, lesser amounts	Lb.	.. —.08½
Sodium Aluminium Phosphate	Lb.	.. —.03½
Sodium Benzoate	Lb.	.75— .80
Sodium Bicarbonate, 100% pure	Lb	2.50— 3.00
Sodium Bichromate, bbls	Lb.	.10— .13
Sodium Bisulphite, powder	Lb.	.05¼— .06
Sodium Bisulphite, 35 Be	Lb.	.03—.03¼
Sodium Bromide (foreign)	Lb.	.. — .24
Sodium Cyanide, bulk, 98-99%, in cases	Lb.	.. — .31
Sodium Fluoride, 95-98%	Lb.	.15 .16
Sodium Hyposulphite, kegs	100 Lb.	5.85— 6.00
Sodium Hyposulphite, barrels	Cwt.	5.25— 5.50
Sodium Iodide	Lb.	.. — 4.60
Sodium Nitrate, refined	Cwt.	6.75— 7.00
Sodium Nitrate, crude, 95%	Cwt.	5.25— 5.75
Sodium Nitrite	Lb	.12— .15
Sodium Perborate, U.S.P.	Lb.	.35— .40
Sodium Peroxide, f.o.b. New York	Lb.	.30— .35
Sodium Silicate, 42°, car lots	Cwt.	.. — 1.35
Sodium Silicate, 42°, smaller lots	Cwt.	.. — 1.55
Sodium Silicate, 40°, car lots	Cwt.	.. — 1.25
Sodium Silicate, 40°, smaller lots	Cwt.	.. — 1.45
Sodium Sulphide, 60-62% fused	Lb.	.08 .09
Sodium Sulphate (Glauber's Salts) crystals,		
	Per Cwt. in Bags	1.80— 2.00
	Per Cwt. in Car Lots	1.65— 1.70
Sodium Sulphite	Lb.	.. — .05
Sodium Prussiate, Yellow	Lb	.24— .25
Sulphur, ground	100 Lb.	2.50— 2.75
Sulphur, roll	100 Lb.	4.25— 4.75
Sulphuric Acid, 66 Be, carboys	100 Lb.	2.25— 2.75
Sulphuric Acid, 66 Be, tank cars, f.o.b. Toronto,	Ton	23.75—24.00
Talc, No. 1 grade	Ton	.. —30.00
Talc, No. 2 grade	Ton	.. —25.00
Talc, No. 3 grade	Ton	.. —23.00
Tin Chloride crystals	Lb.	.30— .35
Tri-sodium Phosphate	Lb.	.07—.07½
Ultramarine, Blue	Lb.	..10— .29
White Precipitate (Mercuric-Ammonium Chloride)	Lb.	.. — 1.60
Whiting (English)	Ton	.. —30.00
Whiting (American)	Ton	.. —30.00
Zinc Sulphate, com.	Lb.	.04—.04½
Zinc Dust	Lb.	.13—.14½
Zinc Oxide, lead free	Lb.	.09— .10
Zinc Stearerate	Lb.	.25— .30

Organic.

Acetanilid, C. P.	Lb.	.45— .50
Acetic Acid, glacial, carboys, f.o.b. Shawinigan Falls	Lb.	.. —.20½
Acetic Acid, glacial, carboys, car lots, f.o.b. Shawinigan	Lb.	.. —.16½
Acetic Acid, glacial, bbls., car lots, fo.b. Shawinigan.	Lb.	.. — .16
Acetic Acid, 28%, carload lots	Lb.	.. —.04¼
Acetic Acid, 28%, 25 bbl. lots	Lb.	.. —.04½
Acetic Acid, 28%, 10 bbl. lots	Lb.	.. —.04¾
Acetic Acid, 28%, 5 bbl. lots	Lb.	.. — .05
Acetic Acid, 28%, 1 or 2 bbl. lots	Lb.	.. —.05¼
Acetic Acid, 80%, carload lots	Lb.	.. —.12½
Acetic Acid, 80%, 25 bbl. lots	Lb.	.. —.14½
Acetic Acid, 80%, 15 bbl. lots	Lb.	.. —.15½
Acetic Acid, 80%, 10 bbl. lots	Lb.	.. — .16
Acetic Acid, 80%, 5 bbl. lots	Lb.	.. —.16½
Acetic Acid, 80%, 3 or 4 bbl. lots	Lb.	.. —.17½
Acetic Acid, 80%, 1 or 2 bbl. lots	Lb.	.. —.18
Acetone, pure, drums or over	Lb.	.. — .21
Acetone, pure, lesser amounts	Lb.	.. — .27
Aspirin, in 100-lb. lots	Lb.	.90— 1.00
Alcohol, Absolute Ethyl, case of 1 doz.	1-lb. bottle	.. — 3.15
Alcohol, Absolute Ethyl, in steel drums of 10 gallons capacity	Imp. Gal.	.. —23.00
Alcohol. acetone, bbls. or over	Gal.	.. — 1.00
Alcohol, acetone, lesser amounts	Gal.	.. — 1.30
Alcohol, wood, 95%, bbls. or over	Gal.	.. — 1.15
Alcohol, wood, 95%, half bbl. lots	Gal.	.. — 1.25
Alcohol, wood, 95%, lesser amounts	Gal.	.. — 1.30
Alcohol, wood, 97%, bbls	Gal.	.. — 1.20
Alcohol, wood, 97%, half bbl. lots	Gal	.. — 1.35
Alcohol, wood, 97%, lesser amounts	Gal.	.. — 1.50
Amyl acetate, technical	Gal.	4.50— 5.00
Amyl Acetate, pure	Lb.	.. — .80
Benzaldehyde	Lb.	1.35— 1.60
Benzoic Acid	Lb.	.85 — .90
Caffeine, English	Lb.	.. — 4.25
Calomel (Mercurous Chloride)	Lb.	.. — 1.25
Camphor, refined, slabs	Lb.	.. — 1.25
Camphor, refined, tal	Lb.	.. — .98
Carbolic Acid, white crystals	Lb.	.20— .22
Chloroform	Lb.	.40— .50
Citric Acid, domestic, crystals	Lb.	.65— .70
Coumarin	Lb.	3.00— 3.50
Cream Tartar, 98%	Lb.	.25— .30
Dextrine, potato	Lb.	.. — .06
Dextrine, corn	Lb.	.. —.08½
Ether, B.P. (conc.)	Lb.	.. — .55
Ether, Sulphuric	Lb.	.28— .38
Formaldehyde, bbls. or over	Lb.	.. —.12¾
Formaldehyde, 200-lb. kegs	Lb	.. —.18¼
Formaldehyde, 100-lb. kegs	Lb.	.. —.19¼
Formaldehyde, 50-lb. kegs	Lb.	.. —.20¼
Formic Acid, 75%	Lb.	.40— .42
Fusel oil, special	Gal.	5.00— 5.25
Fusel oil, refined	Gal.	.. — 6.00
Gallic Acid	Lb.	1.25— 1.75
Glycerine, crude, single tin of 56 lbs.	Lb.	.. — .17
Glycerine, crude, two or more tins	Lb.	.. — .15
Glycerine, C.P., single tin of 56 lbs.	Lb.	.. — .29
Glycerine, C.P., two or more tins	Lb.	.. — .27
Glycerine, (pale straw), single tin 56 lbs.	Lb.	.. — .28
Glycertine, (pale straw). two or more tins	Lb.	.. — .26
Glycerine, C.P. drums, 500-1,000 lbs.	Lb.	.. — .21

Glycerine, pale straw, drums, 500-1,000 lbs.	Lb.	.. — .20
Hexamethylenetetramine		.. — .90
Oxalic Acid	Lb.	.18— .20
Oleic Acid	Lb.	.28— .28
Phenacetin	Lb.	2.00— 2.25
Phenolphthalein	Lb.	.. — 2.00
Pyrogallic Acid	Lb.	2.00— 2.10
Quinine	Oz.	.55— .60
Saccharin	Lb.	2.25— 2.75
Salicylic Acid	Lb.	.. — .45
Starch, corn, ground, car lots	Lb.	.. —.04¼
Starch, potato, ground, car lots	Lb.	.. —.08½
Stearic Acid, Double Pressed	Lb.	.18— .19
Stearic Acid, Triple Pressed	Lb.	.19— .21
Tartaric Acid, crystals or powdered	Lb.	.. — .38
Tannic Acid, commercial	Lb.	.45— .65

C. P. Chemicals.

Ammonia, C.P.	Lb.	.. — .22
Hydrochloric Acid, C.P.	Lb.	.. — .14
Nitric Acid, C.P.	Lb.	.. — .22
Sulphuric Acid, C.P.	Lb.	.. — .13

Industrial Gases.

Acetylene, cylinders	per 100 cu. ft.	2.55— 3.00
Coal Gas, cylinders	per 100 cu. ft.	3.00— 4.00
Hydrogen, cylinders	per 100 cu. ft.	1.50— 2.00
Nitrogen, cylinders	per 100 cu. ft.	2.00— 3.00
Oxygen, cylinders	per 100 cu. ft.	1.50— 2.00

Fertilizer Materials.

Acid Phosphate	Ton	20.00—22.00
Animal Tankage, per unit of Ammonia		.. — 2.65
Animal Tankage, per unit of Bone Phosphate of lime		.. — .10
Nitrate of Soda		.. —68.00
Muriate of Potash	Ton	.. —40.00
Pure Ground Blood, per unit of Ammonia		.. — 3.00
Steamed Bone Meal	Per Ton	25.00—30.00
Sulphate of Ammonia	Ton	.. —65.00

Rubber.

The following quotations on rubber are in American funds, New York delivery:

Crude.

Para, upriver	Lb.	.. — .24
Caucho Ball, upriver	Lb.	.. — .12

Plantation Rubber.

1st Latex Crepe	Lb.	.. —17½
Smoked Sheet	Lb.	.. — .17

Scrap Rubber.

Boots and Shoes	Lb.	.03— .04
Automobile Tires	Lb.	.. — .0½
Steam and fire hose	Lb.	.. —.01⅛
Inner tubes, No. 1	Lb	.. — .06
Inner tubes, No. 2	Lb	.. — .03

Tanning and Dyeing Material

Fustic Crystals	Lb.	.28— .32
Hematine Crystals	Lb.	.20— .26
Logwood Crystals	Lb	.20— .30
Quercitron Liquid Extract	Lb.	.06¾—.07½
Liquid Sumac Extract	Lb.	.07½—.08½
Ground Sumac	Ton	60.00—65.00
Chestnut Liquid Extract	Lb.	.02¼—.02¾
Hemlock Liquid Extract	Lb.	.04½—.04¾
Quebracho Liquid Extract	Lb	.03¾— .04
Quebracho Solid Extract	Lb.	.05¼—.05¾
Liquid Blended Extract (Canadian)	Lb.	.04—.04½

Waxes, Gums, Vegetable and Essential Oils.

Essential Oils—

Cedar, leaf	Lb.	1.90— 2.00
Cedar, wood	Lb.	.. — .80
Camphor	Gal	.. — 1.10
Camphor, white	Lb.	.70— .75
Peppermint, American	Lb.	1.80— 1.90
Peppermint, re-distilled, B.P.	Lb.	2.10— 2.15
Peppermint, Japanese	Lb.	.75— .80

Vegetable Oils—

Anise Oil	Lb.	.. — .80
Castor Oil (Medicinal), in bbl. lots	Lb.	.. — .21
Castor Oil (Commercial), in bbl. lots	Lb.	.. — .19
Castor Oil (Sulphonated)	Lb.	.15— .19
Cocoanut Oil (Refined)	Lb.	.14— .16
Corn Oil, in bbls.	Lb.	.. — .12
Corn Oil, tank cars	Lb.	.10—.10½
Cottonseed Oil, crude, f.o.b. Mississippi Valley points	Lb	.. —.08¼
Cottonseed Oil, crude, f.o.b. Texas points	Lb.	.. — .08½
Cottonseed Oil, summer yellow, f.o.b. Chicago	Lb.	.. —.09¾
Cottonseed Oil, winter yellow, f.o.b. N.Y.	Lb.	.. —.12¼
Linseed Oil, raw, single bbls.	Imp. Gal.	.. — 1.06
Linseed Oil, raw, 5-bbl. lots up	Imp. Gal.	.. — 1.05
Linseed Oil, boiled, 3c per lb. higher than raw		1.08 — 1.09
Monopole Oil	Lb.	.07— .16
Olive Oil, foots, at Toronto	Lb.	.12— .14

Gums—

Indian, No. 1A	Lb.	.. — .30
Indian, No. 1	Lb.	— .27
Tragacanth, No. 1, Ribbon	Lb.	.. — 2.25
Tragacanth, No. 1, Flake	Lb.	.. — 1.50
Tragacanth, Turkey	Lb.	.. — 1.50
Arabic, clear amber sorts	Lb.	.. — .20
Arabic, regular grain No. 4 and No. 5	Lb.	.. — .26
Arabic, regular grain No. 2	Lb.	.. — .27
Arabic, white sorts	Lb.	.. — .30
Arabic, powdered, No. 1	Lb.	.. — .38
Arabic, powdered, No. 2	Lb.	.. — .37

Waxes—

Paraffin, 128°—130°, M.P., 250 lb. lots	Lb.	.. — .06
Paraffin, 118°—120°, M.P., 250 lb. lots	Lb.	.. — .05
Parowax, blocks, 100 lb. lots	Lb.	.. —.08¼
Shellac, T.N.	Lb.	.73— .74
Bone Dry Shellac	Lb.	.84— .86

Beeswax.

Crude, dark	Lb.	.. — .28
Crude, light	Lb.	.. — .48
Refined, dark	Lb.	.. — .35
Refined, light	Lb.	— — .55

Carnauba.

No. 1	Lb.	.. — .50
No. 2	Lb.	.. — .42
No. 3	Lb.	.. — .30
North Country, No. 2	Lb	.. — .32
North Country, No. 3	Lb.	.. — .25
Chalk Grey	Lb.	.. — .23

Ceresin.

White	Lb.	.. — .14
Yellow	Lb.	.. — .13
Montan	Lb.	.. —.08½
Candelilla	Lb.	.. — .45
Japan	Lb.	.. — .22

Oils and Coal Tar Products.

Motor Gasoline	Gal.	.. — .29
Motor Gasoline (service stations)	Gal.	.. — .33
Lighting Gasoline	Gal.	.. — .34
Naphtha	Gal.	.. — .28
Coal Oil	Gal.	.. — .21
Fuel Oil, tank wagons	Gal.	.. — 10.8
Fuel Oil, tank cars	Gal.	.. — 9.8
Mid. Continent Crude (42 W. gal.)	Bbl.	.. — 1.25
Pennsylvania, Crude (42 W. gal.)	Bbl.	.. — 3.00
Crude Creosote Oil, bbls.	Gal.	.. — .40
Refined Creosote Oil, bbls.	Gal.	.. — .60
Crude Coal Tar	Bbl.	.. —10.25
Refined Coal Tar	Bbl.	.. —11.50
Coal Tar Pitch, bbls.	Cwt.	.. — 2.00
Benzol, 100%	Imp.Imp. Gal.	.. — .65
Benzol, 90%	Imp. Gal.	.. — .60
Refined Solvent Naphtha	Gal.	.. — .48
Pure Toluol	Gal.	.. — .52
Dip Oil, 20 per cent. (at New York)	Gal.	.24— .26
Crude Carbolic Acid, 30 per cent.	Gal.	.. — .30
Naphthalin flake	Lb.	.. — .08
Naphthalin balls	Lb.	.. — .09
Alpha-Naphylamin	Lb.	.. — .51

Flotation Oils and Naval Stores.

Rosin, Grade G, in 280 bbl. lots		.. — 8.25
Rosin, Grade W.W., in 280 bbl. lots		.. —10.50
Turpentine, Spirits, 5 bbl. lots up	Imp. Gal.	.. — 1.95

Metals.

Aluminium, 98-99%, 15 ton lots	Lb.	.. —.18¾
Antimony	Lb.	.. —.06¾
Brass, yellow ingots	Lb.	.. — .11
Brass, red	Lb.	.. —.13½
Brass, rods	Lb.	.. — .19
Cobalt, metal	Lb.	3.00— 3.25
Copper, electrolytic, small lots	Cwt.	.. —16.30
Copper, electrolytic, car lots	Cwt.	.. —15.80
Copper, casting, small lots	Cwt.	.. —14.30
Copper, casting, car lots	Cwt.	.. —14.80
Gold, Pure	Oz.	23.00—25.00
Iron, Pig	Ton	.. —33.0
Lead, Pig, small lots	Cwt.	.. — 7.30
Lead, Pig, car lots	Cwt.	.. — 6.80
Magnesium, ribbon	Oz.	.. — 1.50
Magnesium, ribbon	Lb.	.. —18.00
Magnesium, powder	Oz.	.60— .65
Monel Metal, machined rods	Lb.	.. — .50
Monel Blocks	Lb.	. — .34
Monel Metal, shot	Lb.	. — .34
Monel Metal, sheet, hot rolled, on orders of over five hundred pounds, of one gauge	Lb.	.. — .48
Monel Metal, rods, hot rolled	Lb.	.. — .42
Monel Metal, rods, cold rolled	Lb.	.. — .53
Nickel, shot or ingot	Lb.	.. — .35
Platinum, pure	Oz.	..—124.00
Platinum, 5% iridium	Oz.	..—128.00
Platinum, 10% iridium	Oz.	..—138.00
Silver, bar, American silver	Oz.	.. —.99¼
Silver, bar, Canadian produced, U.S. funds	Oz.	.. —.70⅞
Steel, mild, ¼ inch, base price	Cwt.	.. — 3.35
Steel, mild, 3/16 inch, base price	Cwt.	. — 3.85
Steel, nickel, in bars, 3½% nickel	Lb.	. — .20
Steel, sheet, 28 gauge, size 30"	Cwt.	.. — 5.25
Steel, sheet, 28 gauge, size 36"	Cwt.	— 5.35
Steel, sheets, galvanized, 28 gauge, 30"	Cwt.	.. — 6.25
Steel, sheets, galvanized, 28 gauge, 36"	Cwt.	— 6.45
Tin	Lb.	. — .40
Zinc, sheets	Lb.	.12— .14
Zinc (spelter) small lots	Cwt.	. — 8.95
Zinc (spelter) car lots	Cwt.	.. — 8.45

INDEX TO VOL. VI.

1922

Canadian Chemistry and Metallurgy

GENERAL SUBJECT INDEX

- Activated Sludge, The Relation Between Gas Evolved and the Digestion of Sewage in 148
- Alberta and Northwest Territory Oil Notes 139
- Alberta, The Bituminous Sands of 203
- Aluminum Industry, Canadian 96
- American Association for Advancement of Science, Annual Meeting, December, 1921 15
- American Chemical Society 113, 221
- "American Research Chemicals," New Edition of 152
- Ammonia as a Refrigerant 265
- Anhydrous Formic Acid, The Preparation of 63
- Aniline Dyes, A Method of Detecting Biochemical Reactions in Various Fluids, by Means of ....
- Antimony Industry in China 236
- Arsenic in Cobalt Ores and Cobalt Nickel Speiss by the Distillation Method, The Determination of 146
- Arsenide Ores, The Determination of Cobalt and Nickel in 201
- Baking Industry, 1920, Canadian 179
- Bates, John, Ph.D., F.C.I.C. (Sketch) 126
- Blast Furnace Gases as Plant Fertilizers 14
- **Book Reviews:—**
  - Riddle of the Rhine, The 16
  - Mineral Industry During 1920, The 17
  - Bleaching and Related Processes 41
  - Determination of Hydrogen Ions, The 41
  - Emission of Electricity from Hot Bodies 41
  - Modern Chemistry, Pure and Applied 41
  - Qualitative Analysis, Inorganic Substances; Rare Elements 65
  - Industrial Hydrogen 82
  - Comprehensive Treatise on Inorganic and Theoretical Chemistry, A 104
  - Zirconium and its Compounds 104
  - Chemistry of the Non-Benzenoid Hydro-Carbons, The 136
  - Modern Chemistry, Pure and Applied 136
  - Rays of Positive Electricity and Their Application to Chemical Analysis 136
  - System of Qualitative Chemical Analysis, A 136
  - Gas Chemists' Handbook 136
  - Vitamines, The 136
  - Principles and Practice of Fur-Dressing and Fur Dyeing 184
  - Properties of Electrically Conducted System, The 207
  - Calculations of Quantitative Chemical Analysis 207
  - Petroleum: Where and How to Find It 207
  - Chemistry and Technology of Gelatine and Glue, The 227
  - Examination of Hydrocarbon Oils and Saponification Fats and Waxes, The 251
  - Origin of Spectra, The 251
  - American Fuels 251
- Brass Company Locates in Canada, Anaconda American 230
- Brass Industry, Modern Developments in the British 8
- British Columbia Industrial News, 23, 46, 71, 95, 118, 139, 164, 206, 253 276
- British Columbia, Mining and Metallurgy in, 21, 44, 71, 94, 117, 138, 163, 188, 207, 231 274
- Business Outlook, The 115
- Canada, Barium and Strontium in 165
- Canada, Mineral Production in 93, 213
- Canadian Chemists at International Meeting of Agriculturalists, Rome 111
- Canadian Institute of Mining and Metallurgy, Annual Meeting 79
- Canadian Manufacturers, Report on 24
- Canadian Trade, Summary 48
- Canada's Coal Output, 1921 40
- Carbon Black 38
- Carbonization, Low-Temperature 84
- Catalogs Received 24, 48, 97, 167, 191, 232, 253
- Cement Construction, New Aims for 135
- Ceria Earth Compounds, New Method for the Preparation of Pure 83
- Ceramic Industry in Canada, Possibilities for Development 73
- Ceramic Society Visit Canada 219
- Chaulmoogra Oil and Leprosy 86
- Chemical Exposition, Plans for New York 189
- Chemical, Oil and Metal Markets in Canada—Reviewed with Current Market Quotations. .25, 49, 74, 97, 120, 141, 167, 191, 210, 232, 255, 275
- Chemicals at London, Exhibition of 206
- Chemicals and Allied Products, Canada (1919-20), Review of Report on. 275
- **Chemical Society News:—**
  - Toronto Section, Society of Chemical Industry, 16, 70, 67, 88, 134, 160, 250
  - Visit of M. C. L. Morreu, President, International Chemical Union. 38
  - New Members of Canadian Institute of Chemistry, 39, 67, 114, 135, 207, 227, 269
  - Nominations for Council of Canadian Institute of Chemistry 39
  - Ottawa Section, Society of Chemical Industry 39, 90, 113, 270
  - American Electrochemical Society 39, 135, 200, 220
  - Manitoba Chemical Society 65, 88
  - Annual Report of Secretary-Treasurer, Canadian Institute of Chemistry 127
  - Society of Chemical Industry, Montreal Section 66, 269
  - News Items 66, 90
  - Incineration, Address on 67
  - Canadian Pacific Section, S.C.I 68, 112, 183
  - Constructive Chemist, The 89
  - Good, W. C., M.P 89
  - Convention Plans 89
  - Supplementary Report of Secretary, Canadian Institute of Chemistry, Period January 1st, 1922, to May 17th, 1922 128
  - "Professional" Engineers Must Wait 134
  - London Chemists and Manufacturers Getting Together 134
  - Shawinigan Section Hears Address on Steel Manufacture 135
  - Annual Meeting, Society of Chemical Industry, Glasgow 183
  - Report of Council Meeting, Canadian Institute of Chemistry 226
  - Chinese Chemists Organize 227
  - Special Prize for Article on Chemistry 249
  - Opening Meeting, Students' Branch, C.I.C., Kingston 249
  - B. C. Chemist Writes of Technical Problems in Daily Press ....
- Chemist, Putting, it up to the 78
- Chemists and Their Work, The Present Trend of 33
- Chemists, Two Rising:
  - William H. Thom 17
  - Joseph Harris, M.P 17
- Clay Product Men Propose Ceramic Course 69
- Company Notes 74, 120
- Convention of Chemists, Ottawa, May 15th, 16th and 17th, 1922 .... 111, 123
- Copper Sulphate Solutions, Purification of 78
- **Correspondence:—**
  - Poetry of the Sciences, The 3
  - Advisory Conference Committee on Engineering Legislation 28
  - Practical Suggestions on the Research Library Question 54
  - Name for Professional Chemists 195, 213
- "Cracking" Heavy Crude Oils is Still in Experimental Stage, New Process for 152
- Crude Oil From Tar Sands, Company Contract to Extract 37
- Cyanogen Compounds in Canada, The Manufacture of 129
- Developments, New 47
- Donald, J. T. & Co., Move to New Quarters ....
- Dyestuffs in Canada, Some Economic Considerations Related to the Manufacture of 244
- Electrolytic Extraction of Cod Liver Oil 147
- Electroplax Company, The 102, 210
- Electric Heating for Low Temperature Enameling, Development of 265
- Exposition of Chemical Industries, The Eighth National 224
- Feldspar in the Ottawa District 85
- Fertilizer and Oil Shales, Nitrogeneous 84
- Fertilizer Materials, A Possible 83
- Firms Exhibiting in the Chemical Hall, British Industries Fair, London, February 27th-March 10th, 1922 43
- Furnace Design, Principles of High Temperature 246
- Gasoline, Distillation Method Recommended for Determining Volatility of Natural Gas 164
- Gasoline from Natural Gas, The Absorption of 177, 196
- Gasoline, The Production of 55
- Generators, Building Queenston 105
- Good, W. C., M.P. (Sketch) 89
- Graphs, Physical Testing Rubber 214
- Gypsum, Development, New 62
- Health Considerations in Industries Using Chemicals and Chemical Processes 78
- How the Institute Can Best Serve Canadian Chemists 125
- Hydrocarbons, Process for Volatilising and Decomposing 158
- Ignition Temperature of Wood, The Effect of Chemicals on the 172
- Industrial Items and Developments 96, 119, 141, 166, 210, 232, 253
- Industrial Metallography, Extension Course in 216
- International Union of Pure and Applied Chemistry, Meeting of 108
- Iron and Steel: A Great Maritime Province Industry 153
- Iron and Steel in Canada, Production of 32, 210, 216
- Leather Chemists' Convention, American 159
- Le Sueur, A Review of the Work of Ernest A 5, 29
- Linseed Oil Industry in Canada, The Liquid Chlorine Plant, First Canadian 270
- Liquid Chlorine Plant, First Canadian 264
- Longmans, Green & Co. Establish Canadian Branch 147
- Malt Liquor Industry, The Canadian 180
- Maritime Chemists' Association, August Meeting 217
- McGill, Dr. A. (Sketch) 269
- Metric Association of Toronto, Annual Meeting 40
- Mines, Ottawa, Investigation by the Mines Branch, Department of 185
- National Drug & Chemical Co., Ltd., New President of 145
- National Exposition of Chemical Industries, 1922 141
- Newfoundland, New Steel Plant for 158
- Non-Ferrous Alloys, Conference on 135
- Northern Explosives Co., Ltd., Dragon, P.Q., Plant of 101
- Oil Chemists Meet at New Orleans 135
- Oil Developments, Western 23
- Ontario Department of Mines, Reports of 163
- Ontario Gold Deposits, Report on 141
- Ontario Iron Ores, A Conference on 187
- Ontario Mining Developments, Northern 22, 47, 208
- Ontario's Mineral Production 4, 73, 228
- Overseas and Foreign Industrial News 18, 42
- Paper Research, Fields of 249
- Patents of Special Interest, Latest Chemical and Metallurgical 23, 72, 95, 118, 140, 165, 254
- Petroleum Production in the United States 151
- Pharmaceutical Items of Tariff, Changes in 145
- Phospho-Potash Process, The 4
- Pigments, The Manufacture and Use of Black 156, 180
- Potash Situation, How Germany Sees the 171
- Provincial Paper Mills, Expansion of 88
- Quebec, Mineral Production, 1921 119
- Registered Professional Engineers ....
- Regulations for Shipping Natural Gas, Gasoline, Proposed 86
- Regulations Regarding the Use of Alcohol in Proprietary and Pharmaceutical Preparations 86
- Relation of Iron to Activated Sludge 131
- Reports Received 24, 167, 232
- Respirators, Development of 274
- Rubber Association, Annual Meeting 97
- Rubber in the Paper Field, New Uses for 104
- Rubber, Physical Testing Graphs, Illustrating Tests on Vulcanized 214
- Rubber Surplus, Estimating World's 14
- Rubber, The Construction of 237
- Rust on Iron and Steel, The Prevention of 13
- Salt Solutions on Aluminium, Copper, Lead and Zinc, The Action of Several 151
- Saskatchewan, Economical Mineral Resources of Northern 35
- Saskatchewan, Industrial Minerals in Northern 4
- Silver, Notes on the Detection and Estimation of Small Amounts of Platinum and Palladium in the Presence of Large Amounts of 179
- Soapstone in Ontario, A New Source of 205
- Steam by Electricity, Generation of 59
- Sulphuric Acid in Tank Car Shipments, Handling 13
- Sulphuric Acid Towers 219
- Sulphur from Illuminating Gas, Removal of 243
- Technical Photographers Form Society 128
- Trademark of Quality, A 24
- United Kingdom Trade Returns 65
- Vapor Pressure of Aqueous Solutions, The Relative Lowering of 109
- Visit to the Packers' Hospital, Chicago, A 87
- West Indies, Canadian Manufacturers Visit 54
- World Conditions and News in Chemical Fields, 69, 91, 116, 137, 162, 186, 209, 229 .... 252, 275
- Yukon Territory News 37, 41,

INDEX TO AUTHORS

Alliott, E. A.—A Visit to the Packers' Hospital, Chicago 87
Banfield, W. O.—The Effect of Chemicals on the Ignition Temperature of Wood 172
Bates, John S.—How the Institute Can Best Serve Canadian Chemists 125
Blachford, H. L.—The Manufacture and Use of Black Pigments 156, 180
Boswell, Maitland C.—The Preparation of Anhydrous Formic Acid 63
The Relative Lowering of Vapor Pressure of Aqueous Solutions 109
The Constitution of Rubber 237
Cantelo, R. C.—The Relative Lowering of Vapor Pressure of Aqueous Solutions 109
The Absorption of Gasoline from Natural Gas 177, 196
Corman, H. S.—The Preparation of Anhydrous Formic Acid 63
Crowe, Cyril H.—The Action of Several Salt Solutions on Aluminium, Copper, Lead and Zinc 151
Davis, N. B.—Feldspar in the Ottawa District 85
Donald, J. R.—Plant of the Northern Explosives Co., Ltd., Dragon, P.Q. 101
Foot, Gerald A.—Handling Sulphuric Acid in Tank Car Shipments 13
Freeman, Horace—The Manufacture of Cyanogen Compounds in Canada 129
Hambly, F. J.—The Present Trend of Chemists and Their Work 33
Hammond, E. W.—A Method of Detecting Biochemical Reactions in Various Fluids by Means of Aniline Dyes 58
Kaelin, F. T.—Generation of Steam by Electricity 59
Knittel, C. A.—The Determination of Arsenic in Cobalt Ores and Cobalt Nickel Speiss by the Distillation Method 146
Notes on the Detection and Estimation of Small Amounts of Platinum and Palladium in the Presence of Large Amounts of Silver 179
The Determination of Cobalt and Nickel in Arsenide Ores 201
Lucas, George H.—The Relation of Iron to Activated Sludge 131
The Relation Between Gas Evolved and the Digestion of Sewage in Activated Sludge 148
MacLeod, W. A.—Economical Mineral Resources of Northern Saskatchewan 35
Manske, Richard H. F.—New Method for the Preparation of Pure Ceria Earth Compounds 83
Motz, W. H.—Ammonia as a Refrigerant 260
Peck, W. S.—The Effect of Chemicals on the Ignition Temperature of Wood 172
Schorman, W. A. P.—The Production of Gasoline 55
Scott, Wirt S—Development of Electric Heating for Enameling 265
Smalley, E. L.—Principles of High Temperature Furnace Design 246
Smith, Ernest T.—Modern Developments in the British Brass Industry 8
Spence, H. S.—A New Source of Soapstone in Ontario 205
Westman, L. E.—A Review of the Work of Ernest A. Le Sueur 5, 29
Wiegand, W. B.—Physical Testing Graphs 214
Wright, C. R.—Some Economic Considerations Related to the Manufacture of Dyestuffs in Canada 244

INDEX TO LEADING EDITORIALS

A.C.I.C. 26
"Alkali" Waters, Joint Research on 212
Annual Meetings, Ottawa 26
Between the Upper and Nether 169
Big End vs. Small End 258
Budget, The 121
Chemical Writers 235
"Chemicals and Allied Products" 257
Chemistry, Measured Annually 169
Chemor, Chemistor, Chemicor 171
Collaboration 77
Collars vs. Overalls 121
Commission, The Right Kind of 194
Committee, A Practical 235
Consciousness, Have Canadian Chemists No Class 212
Consolidating the Effort 99
Co-operation and the Lesser Fleas 193
Dyes on Exhibition, Canadian 52
F.C.I.C. 26
Give the Boys a Chance 52
Government, Work for the New 2
Graphite, Canadian 195
Industrial Education, A New Phase of 211
Institute Makes Progress, Canadian 211
Insulin 236
Libraries for Research Workers 26
Meetings in Canada, Summer 169
Name, What About A 143
National Research Institute Not a Free Custom Laboratory 53
Northern Ontario 257
Opinion, A Remarkable 170
Outlook, The Business 99
Poison Gas, The Case for 100
Presidents, Secretaries and a Treasurer 122
Protection Holding us Back? Is 94
Putting in or Taking Out 195
Research, The Sidelines of 236
Resources, Knowing Our Own 28
Rubber in Canada 193
Rubber, New Uses for 3
Science, A Dividend for 76
Scientists, Co-Operation Among 3
Sense, Good Sound 100
Service Rendered, For 122
Stolen Ideas 236
Synthetic Petroleum Research 53
Syracuse, Great News From 144
Talk, How We 144
Way of a Man With a Money-Bag, The 143

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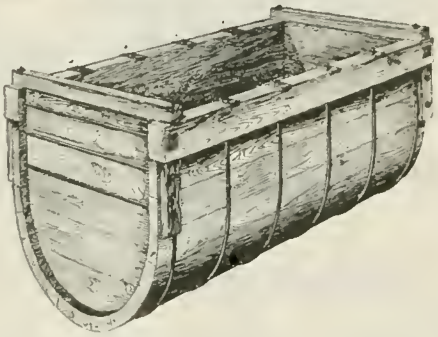

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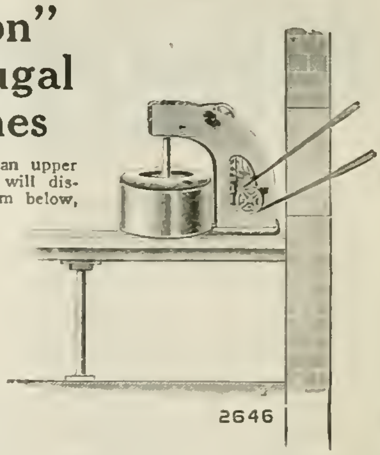

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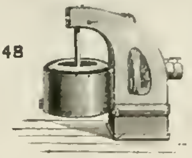

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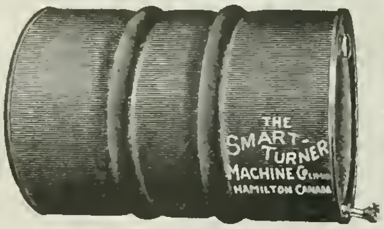

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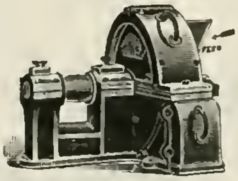

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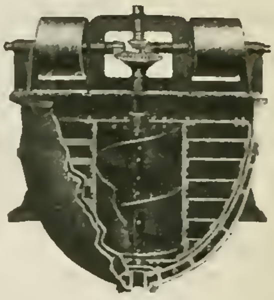

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